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THE REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

VOL. V.

ISSUED BY THE IMPERIAL
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ERRATA.

Page	1 line	1	for	" Reeves (G. T.) "	read	" Reeves (G. I.)."
,,	3 ,,	40	,,	" jak (*Careya arborea*)"	,,	" jak, *Careya arborea*."
,,	4 ,,	1	,,	" *curcubitae* "	,,	" *cucurbitae*."
,,	4 ,,	6	,,	" *scutellaris* "	,,	" *scutellarius*."
,,	10 ,,	43	,,	" *entettixi* "	,,	" *eutettixi*."
,,	17 ,,	28	,,	" *Maxon* "	,,	" *Maxson*."
,,	18 ,,	12	,,	" *angustifoliae* "	,,	" *angustifolia*."
,,	63 ,,	1	,,	" *Micropterys* "	,,	" *Microterys*."
,,	67 ,,	3	,,	" *Pardianlomella* "	,,	" *Pardiaulomella*."
,,	67 ,,	4	,,	" *Gemocerus* "	,,	" *Geniocerus*."
,,	103 ,,	36	,,	" Alfieri (M. A.) "	,,	" Alfieri (A.)."
,,	103 ,,	43	,,	" Alfieri (H. A.) "	,,	" Alfieri (A.)."
,,	114 ,,	11	,,	" *Brochymena* "	,,	" *Brachymena*."
,,	114 ,,	11	,,	" *Alcoeorrhynchus* "	,,	" *Alcaeorrhynchus*."
,,	122 ,,	27	,,	" *scandida* "	,,	" *scandica*."
,,	124 ,,	42	,,	" *Schoenobius* "	,,	" *Scirpophaga xanthogastrella*."
,,	130 ,,	17	,,	" Ser. A, v, p. 757 "	,,	" Ser. A, v, p. 75."
,,	131 ,,	15	,,	" *Lyntherisma* "	,,	" *Syntherisma*."
,,	140 ,,	16	,,	" *C. oculata* "	,,	" *Chrysopa oculata*."
,,	141 ,,	9	,,	" p. 100 "	,,	" p. 110."
,,	149 ,,	15	,,	" *Lygyrus* "	,,	" *Ligyrus*."
,,	151 ,,	46	,,	" *segetis* "	,,	" *segetum*."
,,	157 ,,	21	,,	" *horidellum* "	,,	" *horridellum*."
,,	158 ,,	2	,,	" *Laemophlaeus* "	,,	" *Laemophloeus*."
,,	163 ,,	16	,,	" *platypenae* "	,,	" *platyhypenae*."
,,	163 ,,	38	,,	" jak-fruit (*Careya arborea*) "	,,	" *Careya arborea*."
,,	165 ,,	30	,,	" *vogilii* "	,,	" *vogelii*."
,,	179 ,,	19	,,	" *brevicornis* "	,,	" *brevicomis*."
,,	189 ,,	9	,,	" *Agryresthesia* "	,,	" *Argyresthia*."
,,	204 lines	8 & 11	for	" *Amphrophora* "	,,	" *Amphorophora*."
,,	231 ,,	17 & 23	for	" Rio de Janeiro."	,,	" S. Paulo."
,,	232 ,,	2 & 9	for	" Rio de Janeiro "	,,	" S. Paulo."
,,	236 line	29	for	" *Festina* "	,,	" *Festuca*."
,,	242 ,,	28	,,	" *Bathyrix* "	,,	" *Bathythrix*."
,,	244 ,,	33	,,	" Sasscer (E. R.)	,,	" Sasscer (E. R.) & Borden (A. D.) "
,,	264 ,,	37	,,	" Rose (W. A.) "	,,	" Ross (W. A.)."
,,	271 lines	15 & 23	for	" Rio de Janeiro"	,,	" S. Paulo."
,,	292 line	46	for	" *Dichocrosis* "	,,	" *Dichocrocis*."
,,	277 ,,	13	,,	" *T. rubiella* "	,,	" *I. rubiella*."
,,	280 ,,	32	,,	" *rufus* "	,,	" *rufovillosum*."
,,	287 ,,	17	,,	" Headlee (T. H.) "	,,	" Headlee (T. J.)."
,,	287 ,,	38	,,	" Davidson (W. H.) "	,,	" Davidson (W. M.)"
,,	294 ,,	34	,,	" avocada "	,,	" avocado."
,,	294 ,,	40	,,	" Ehrhorn (E. H.) "	,,	" Ehrhorn (E. M.)."
,,	305 ,,	33	,,	" *Ceratoma* "	,,	" *Cerotoma*."
,,	315 ,,	33	,,	" *brilliana* "	,,	" *brillians*."

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Errata—*cont.*

Page	319	line	10	for	"*Rhaphanus*"	read	"*Raphanus.*"
,,	322	,,	35	,,	"*cespitum*"	,,	"*caespitum.*"
,,	323	,,	11	,,	"*catalpa*"	,,	"*catalpae.*"
,,	324	,,	26	,,	"*Diapis*"	,,	"*Diaspis.*"
,,	331	,,	43	,,	"*brassica*"	,,	"*brassicae.*"
,,	335	,,	8	,,	"*fava*"	,,	"*faba.*"
,,	339	,,	14	,,	"*Pimela*"	,,	"*Pimelia.*"
,,	344	,,	42	,,	"*consanguinea*"	,,	"*consanguinana.*"
,,	347	,,	40	,,	"*tenthredinis*"	,,	"*tenthredinidis.*"
,,	350	,,	33	,,	"*adonidum*"	,,	"*aonidum.*"
,,	351	,,	20	,,	"*Chematobia*"	,,	"*Cheimatobia.*"
,,	369	,,	27	,,	"*aculifera*"	,,	"*jaculifera.*"
,,	372	,,	16	,,	"*Mesostermes*"	,,	"*Mesosternus.*"
,,	375	,,	7	,,	"Johnston (J. B.)"	,,	"Johnston (J. R.)."
,,	404	,,	36	,,	"*caprae*"	,,	"*caprea.*"
,,	405	,,	16	,,	"*Chrysocharus*"	,,	"*Chrysocharis.*"
,,	408	,,	46	,,	"*nympheae*"	,,	"*nymphaeae.*"
,,	409	,,	7	,,	"*Nymphea*"	,,	"*Nymphaea.*"
,,	418	,,	17	,,	"*Omotemmus*"	,,	"*Omotemnus.*"
,,	421	,,	22	,,	"*sabilis*"	,,	"*sabalis.*"
,,	431	,,	12	,,	"*Palaecoccus*"	,,	"*Palaeococcus.*"
,,	431	,,	24	,,	"*Orthesia*"	,,	"*Orthezia.*"
,,	440	,,	43	,,	"*Galeote*"	,,	"*Calotes.*"
,,	456	,,	46	,,	"*globusa*"	,,	"*globosa.*"
,,	464	,,	12	,,	"*Aprostectus*"	,,	"*Aprostocetus.*"
,,	483	,,	11	,,	"*hebecella*"	,,	"*hebescella.*"
,,	503	,,	49	,,	"*Ectatoma*"	,,	"*Ectatomma.*"
,,	504	,,	35	,,	"*tenebrioides*"	,,	"*tenebrionis.*"
,,	511	,,	35	,,	"*Enoporicus*"	,,	"*Ernoporicus.*"
,,	526	,,	44	,,	"*Leucopsis*"	,,	"*Leucopis.*"
,,	530	,,	19	,,	"*Ceratoma*"	,,	"*Cerotoma.*"
,,	534	,,	44	,,	"this pest"	,,	"*Tomaspis flavilatera.*"
,,	568	,,	19	,,	"Swaine (J. H.)"	,,	"Swaine (J. M.)."
,,	580	,,	47	,,	"*viridis*"	,,	"*viridula.*"

NOTICE.

Subscriptions to the Review of Applied Entomology became due on 1st of January and should be sent to the As istant Director, Imperial Bureau of Entomology, 89, Queen's Gate, S.W., or through any bookseller.

The Subject Index to the first three volumes of Series "A" is now in the press and will be ready shortly. Copies, price 5/- each post free, may be obtained from the Assistant Director, as above.

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SERIES A.

VOL. V.] [1917.

REEVES (G. T.), MILES (P. B.), CHAMBERLIN (T. R.), SNOW (J. S.) & BOWER (L. J.). **The Alfalfa Weevil and Methods of Controlling it.** —*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 741, 17th July 1916, 16 pp., 7 figs. [Received 19th October 1916.]

This bulletin deals with the manner in which *Hypera variabilis*, Hbst. (*Phytonomus posticus*, Gyll.) (alfalfa weevil) is spreading and with methods of controlling it. This insect does an enormous amount of damage to the lucerne crop, and in Utah the annual loss is estimated at £600,000. No definite channels of distribution have been discovered, but recent observations point to the weevils being carried in green lucerne hay or new hay of the second crop, or on the clothing of persons who have been in infested fields. The spread of this pest appears to occur along high roads, rather than along railway lines, which tends to confirm the theory that they are carried by persons travelling along country roads. It is slowly spreading in all directions and may in time infest most of the United States. No isolated colonies distant from the main area now infested have been reported, though the weevils have been found in railway trucks, especially refrigerator cars.

A full account is given of the life-history of this weevil and the relation between its habits and the methods that must be employed for its destruction. Spring cultivation is expensive and does not have any appreciable effect on the weevils, but hastens the growth of the crop, so that, in spite of the pest, a large yield is obtained when an early cutting is necessary. Spring spraying with a mixture of four pounds of zinc arsenite in 100 U.S. gallons of water, using 50 to 100 gallons to the acre, is often effective. Arsenate of lead can be used in place of this, but is usually less satisfactory. It is often desirable to employ both these methods. If spraying cannot be carried out, pasturing the crop of lucerne before the eggs have hatched is often beneficial. The amount to be grazed must be limited to the head of stock, so that it may be cropped effectively and the herd moved to fresh ground as soon as each area has been cropped ; this should be in about

two weeks. Cutting the lucerne while green, two or three times during the season, and using it as fodder, will have the same result. The dust mulch may be used with advantage where the weevils have not been destroyed earlier in the year. This is best done after the first crop has been cut, when the ground is dry and the weather warm and bright. The chief objection to this method is that it requires time and labour at the busiest period of the year. Summer spraying after the first crop has been harvested has been found effective, the mixture used being Paris green or arsenate of lead in the proportion of 1 pound and 6 pounds, respectively, to 100 U.S. gallons of water. Puddling is not recommended, being harmful to the soil. To prevent the spread of this pest to new ground care should be taken to avoid sending either new lucerne, or articles which have come in contact with it, out of the infested district.

EHRHORN (E. M.). **Report of the Division of Plant Inspection.**—*Hawaiian Forester & Agriculturist, Honolulu,* xiii, no. 8, August 1916, pp. 299–301. [Received 27th October 1916.]

Among the pests intercepted in July 1916 were *Pseudococcus bromeliae* on pine-apple from Queensland, *Aspidiotus cyanophylli* on orchids from New Jersey, *Hemichionaspis aspidistrae* and *Saissetia hemisphaerica* on a fern from Ohio, and *Bruchus pisorum* in dried peas.

FULLAWAY (D. T.). **Report of the Division of Entomology.**—*Hawaiian Forester & Agriculturist, Honolulu,* xiii, no. 8, August 1916, pp. 302–303. [Received 27th October 1916.]

During July 1916, 1,485 female and 674 male individuals of *Opius fletcheri,* the new melon-fly parasite, were reared, and 1,718 were liberated.

FULLAWAY (D. T.). **Search for Melon Fly Parasites.** — *Hawaiian Forester & Agriculturist, Honolulu,* xiii, no. 8, August 1916, pp. 303–306. [Received 27th October 1916.]

In this report the author describes his search for parasites of the melon fly [*Dacus cucurbitae*]. Singapore, Java, South India and Manila were visited, and *Opius fletcheri* was secured in South India, at Bangalore, and has been introduced into Hawaii [see above].

Destruction of Food-plants of the Cotton Stainer in St. Vincent.—*Agric. News, Barbados,* xv, no. 376, 23rd September 1916, p. 319.

In connection with the work of destroying food-plants of the cotton stainers [*Dysdercus delauneyi*] in St. Vincent [see this *Review,* Ser. A, iv, p. 470] a large number of silk cotton trees (*Eriodendron anfractuosum*) and John Bull trees (*Thespesia populnea*) have been destroyed. Up to the present the greater part of the windward district has been cleared; work in the leeward district was begun in August.

SKERETT (R. G.). **Scientific Annihilation of the Tobacco Beetle.**—*Scientific American, New York,* cxv, no. 15, 7th October 1916, pp. 319 & 336.

This article describes an X-ray apparatus used at a cigar factory at Tampa against *Lasioderma serricorne* (cigarette beetle) [see this *Review,* Ser. A, iv, p. 385]. The machine can treat 40,000 cigars an hour. After being placed in boxes, they are put on a belt which travels through the machine a distance of 23 feet in 20 minutes. The apparatus contains two X-ray tubes, operating at 45,000 volts, and a current of 100 milliampères is passed through them. For 4½ minutes the cigars are exposed to the direct rays and to reflected rays for the greater part of 15 minutes. The machine is extremely simple in construction. It enables cigar-manufacturers to carry on work throughout the year, whereas, up to the present, it has been done chiefly before Christmas on account of the loss in large stocks due to infestation by *L. serricorne.*

DUBOIS (P.). **Les Ennemis des Arbres Fruitiers.** [Fruit-tree Pests.]—*La Vie Agric. et Rur., Paris,* vi, no. 43, 21st October 1916, pp. 306–309, 1 fig.

This paper deals with *Cheimatobia brumata,* which attacks many fruit-trees, including the pear, cherry, peach, apricot and apple. The last-named suffers very severe injury over a belt extending through France from Normandy to the department of Gard, on the Mediterranean coast, west of Marseilles. The life-history and habits are described, together with control methods, banding being treated in detail. Non-success in banding is due to incorrect construction, wrong date of application, and carelessness in up-keep. Eight formulae for banding adhesives are recommended [see however this *Review,* Ser. A, iv, p. 482].

BEZZI (M.). **On the fruit-flies of the genus** *Dacus* **(s. l.) occurring in India, Burma and Ceylon.**—*Bull. Entom. Research, London,* vii. no. 2, October 1916, pp. 99–121.

This paper includes keys to the Oriental and Australian genera of DACINAE at present known and to all the Indian species.

The following species, some of which are new, are recorded :—*Dacus* (*Leptoxyda*) *longistylus,* Wied., from *Calotropis* ; *D. brevistylus,* Bezzi, from melon and water melon ; *D.* (*Chaetodacus*) *ferrugineus,* F., from guava, loquat, mango, peach and pomelo ; *D.* (*C.*) *ferrugineus dorsalis,* Hendel, from loquat, mango, peach, chillies, pomelo, guava, *Solanum verbascifolium,* and pear ; *D.* (*C.*) *ferrugineus incisus,* Walk., from jak (*Careya arborea*), mango, guava and *S. verbascifolium* ; *D.* (*C.*) *ferrugineus versicolor,* var. nov., from guava, sapodilla and mango ; *D.* (*C.*) *zonatus,* Saund., from peach, fig, sapodilla, Bael fruit, *Careya arborea,* mango, peach, and white gourd ; *D.* (*C.*) *tuberculatus,* sp. n., from peach ; *D.* (*C.*) *correctus,* (*Bactrocera zonata,* Bezzi *nec* Saund.), nom. nov., from peach, mango, and castor ; *D.* (*C.*) *duplicatus,* sp. n., from peach ; *D.* (*C.*) *diversus,* Coq., from orange, jaman, mustard, mango, and white gourd ; *D.* (*C.*) *maculipennis,* Dol., on cholam and wild vine ; *D.* (*C.*) *hageni,* Meij., from gourd ; *D.* (*C.*)

curcubitae, Coq., from *Cucumis*, *Momordica charantia*, pumpkin, *Luffa aegyptiaca*, melon, musk melon, and *Trichosanthes cucumerina* ; *D.* (*C.*) *caudatus*, F., from grass, skaki gourd, *Trichosanthes palmata*, and pomelo ; *D.* (*C.*) *garciniae*, Bezzi, from *Garcinia* ; *D.* (*C.*) *scutellarius*, sp. n. ; *D.* (*C.*) *biguttatus*, sp. n. ; *D.* (*C.*) *bipustulatus*, Bezzi ; *D.* (*C.*) *scutellaris*, Bezzi ; *Mellesis sphaeroidalis*, gen. et sp. n., *M. brachycera*, sp. n. ; *M. crabroniformis*, Bezzi ; *M. destillatoria*, sp. n. ; *M. eumenoides*, sp. n., from *Trichosanthes cucumerina* and cucumber ; *Adrama austeni*, Hendel.

The paper closes with an index of the scientific names of 30 plants, with the respective species attacking them. This shows that the forms of *D. ferrugineus* and its allies breed on various plants of different families, but never on Cucurbitaceae, while *C. cucurbitae* and its allies feed only on plants of that family. The polyphagous species, like *D. ferrugineus* and *D. cucurbitae*, are very variable in their characters. Only species or forms of the *D. ferrugineus* group are attracted by oil of citronella.

Waterston (J.). **Notes on African Chalcidoidea—V.**—*Bull. Entom. Research, London*, vii, no. 2, October 1916, pp. 123–132, 5 figs.

The following Chalcidoidea are described :—*Sycophaga cyclostigma*, sp. n., from wild figs, and *Colpixys necator*, sp. n., bred from the Erotylid beetle, *Barbaropus paradoxus*, Olliff, in Southern Rhodesia.

Waterston (J.). **Notes on Coccid-infesting Chalcidoidea—I.**—*Bull. Entom. Research, London*, vii, no. 2, October 1916, pp. 137–144, 3 figs.

The following species are described :—*Diversinervus silvestrii*, sp. n., and *Tetrastichus sicarius*, Silv., both bred from *Coccus* (*Lecanium*) *viridis* on coffee in Mauritius, and *Coccophagus acanthosceles*, sp. n., from *Lecanium* sp. at Singapore.

Green (E. E.). **Notes on Coccidae occurring in the Seychelles Islands, with Descriptions of New Species.**—*Bull. Entom. Research, London*, vii, no. 2, October 1916, pp. 193–196, 3 figs.

A description is given of the following new Coccidae from the Seychelles :—*Aspidiotus* (*Chrysomphalus*) *ansei*, from fronds of coconut (*Cocos nucifera*) ; *Gymnaspis grandis*, from fruit of *Lodoicea sechellarum* (Coco de Mer) ; and *Lepidosaphes duponti*, on leaf-stalks of coconut. Since the publication (in Trans. Linn. Soc. Lond., xii, part 2, p. 197, 1907) of a list of Coccidae occurring in the Seychelles, the following additional species have been identified in collections received from Mr. Dupont :—*Lecanium mangiferae*, Green, on cinnamon and imported mango plants ; *Aspidiotus dictyospermi pinnulifera*, Mask., on *Jasminum*, *Thunbergia*, *Pandanus*, and coconut ; *A. bromeliae*, Newst., on pine-apple ; *Ischnaspis filiformis*, Dougl., on oil-palm ; *Parlatoria pergandei*, Comst., on *Thunbergia*.

MARSHALL (G. A. K.). **A new weevil attacking pine-apples in Jamaica.** —*Bull. Entom. Research, London,* vii, no. 2, October 1916, pp. 197–198.

This paper describes *Metamasius ritchiei*, sp. n., a large black weevil which has been found doing serious damage to pine-apples in Jamaica.

[There is reason to suppose that the species has been introduced from South America.—ED.]

MUNRO (J. W.). *Hylastes cunicularius*, **Er., and its Relation to the Forest.**—*Scottish Naturalist, Edinburgh,* no. 59, November 1916, pp. 275–281, 3 figs.

Three species belonging to the genus *Hylastes* are of economic importance in Scotland, viz:—*H. ater*, Pk., *H. palliatus*, Gyl., and *H. cunicularius*, Er. Observations on the last-named, made in Aberdeenshire and Peeblesshire, show that it lives in the larval stage in the roots of spruce, preferably in those from ½ to 2 inches in diameter, a short distance below the surface of the soil. The larval galleries ultimately form a large cavity, from which pupation chambers arise at intervals. The adults on emergence are sexually immature and attack young conifers just below the root-collar, where they girdle the stem, prevent the sap-flow and cause the death of the tree. This species is often accompanied by *Hylobius abietis*, L., which injures the tree above the level of the ground. In areas under observation the loss caused by the adults of *H. cunicularius* was not less than £1 per acre, reckoning the cost of planting at £3 per acre. As a preventive measure, the burning of brushwood on the tops of stumps may be of value if carried out just before or during the egg-laying period in April or May.

Trapping the Fruit-fly and Moths.—*Queensland Agric. Jl., Brisbane,* vi, no. 3, September 1916, p. 188.

A method suggested for trapping the fruit-fly (*Ceratitis capitata*) consists of hanging in the fruit trees pieces of board or tin painted with luminous paint and then covered with some adhesive substance.

Grub Pest of Sugar-Cane. Remedial Measures Suggested.—*Queensland Agric. Jl., Brisbane,* vi, no. 3, September 1916, p. 202.

Attention is drawn in this article to the value of poison bait for controlling *Lepidiota albohirta* [see this *Review*, Ser. A, iv, p. 470].

JARVIS (E.). **Control of Insect Enemies of the Sugar-Cane.**—*Queensland Agric. Jl., Brisbane,* vi, no. 3, September 1916, pp. 202–204.

Field observations regarding insects predaceous on the minor pests of sugar-cane have led to the discovery of a small arboreal earwig, probably a species of *Labia*, which is evidently an important enemy of *Aphis sacchari*, L. This earwig frequents cane-fields in the vicinity of Gordonvale at all times of the year.

Rutherford (A.). **A New Scale-Insect affecting Sugar-Cane in New Guinea.**—*Proc. Linn. Soc. New South Wales, Sydney*, xli, no. 2, May-August 1916, pp. 215–216. [Received 6th November 1916.]

Aulacaspis major, sp. n., found on the stems of sugar-cane in New Guinea, is described.

Froggatt (W. W.). **The Tomato and Bean Bug.**—*Agric. Gaz. New South Wales, Sydney*, xxvii, no. 9, 2nd September 1916, pp. 649–650, 1 plate.

Nezara viridula, L. (the tomato and bean bug) has been recently introduced into the vegetable gardens of New South Wales. It first appeared on tomatoes in the neighbourhood of Sydney about five years ago, and it also attacks the foliage and young pods of French beans, and potatoes. In Florida and Louisiana it infests cotton, orange and vegetables. It has been recorded from various places in Europe, Asia, Africa and North America. The female oviposits in masses on the surface of the foliage. As these are very conspicuous, it is an easy matter to remove infested leaves. The adults may be collected by spreading a sheet under the plants and shaking them into it. During the early stages of development, before the integument becomes hardened, oil sprays or tobacco and soap washes will prove effective against this pest.

Allen (W. J.). **Orchard Notes.**—*Agric. Gaz. N.S.W., Sydney*, xxvii, no. 9, 2nd September 1916, pp. 678–680.

Spraying with arsenate of lead for codling moth [*Cydia pomonella*] is now compulsory in New South Wales. The regulations, published in October 1914, under the Vine and Vegetation Diseases and Fruit Pest Act of 1912 are given in full. A table shows the weight of various brands of arsenate of lead paste to be used so that the resulting mixture shall contain as much dry lead arsenate as is equivalent to 18 oz. of arsenate of lead in the dry state to each 50 gallons of water. Soft water is the best for this spray. Experiments in several government orchards with lime-sulphur sprays have given contradictory results, and several days must elapse before deciding that any given strength is suitable, as the damage done may not become apparent for a week or even longer.

Froggatt (W. W.). **A Remarkable Gall Mite on Privet** (*Ligustrum vulgare*).—*Agric. Gaz. N.S.W., Sydney*, xxvii, no. 9, 2nd September 1916, p. 681, 2 figs.

An Oribatid mite, allied to the genus *Leiosoma* is recorded as forming galls on stems of privet in Sydney.

Patterson (W. H.). **Report of the Entomologist.**—*Rept. Agric. Dept. Gold Coast for* 1915, *Accra*, 1916, pp. 19–21.

This report contains further notes on *Sahlbergella singularis*, Hagl., *S. theobroma*, Dist., and *Helopeltis bergrothi*, Reut. [see this *Review*, Ser. A, ii, p. 670, and iii, p. 528]. Many thousands of acres of cacao are

rendered worthless by the first two insects. The efforts to control them have been on such a small scale that they have had an almost undisputed field of operations since they were first noticed in 1909. The seriousness of the position is obscured by the huge increase of cacao exported, which is due entirely to new areas coming into bearing. The present system of cultivation cannot go on indefinitely, as the decreasing yield of the older plantations, as well as the spread and large increase of damage and loss caused by the wound fungus, *Diplodia* sp., must be largely if not entirely credited to the suctorial enemies of cacao. Control measures can only be worked along the lines indicated in 1914. Unless abandoned plantations are destroyed, badly infested areas quarantined, and the extension of planting limited, it is to be feared that the industry will reach the verge of extinction before a new system is evolved. *Helopeltis bergrothi* has also been found feeding on the soft shoots of *Strophanthus gratus* and of *Cryptostegia madagascariensis.* With regard to the doubt which still exists as to how this and other species in other parts of the world pass through the dry season [see this *Review*, Ser. A, iii, p. 661], it is stated to have been found in this Colony in small numbers in open places as well as in moist, sheltered spots during that period. No progress can be reported in the control of this pest. As it breeds in fairly large numbers on plants of *Acalypha*, *Bixa* and *Aralia* adjacent to cacao at Aburi and yet seldom does damage to cacao on an economic scale in the gardens, it may be found possible to cultivate hedges of these plants round cacao with a view to trapping the insects upon them.

Homoeocerus sp., which is slowly spreading in the Aburi district, and does serious damage to cacao, has been found breeding and feeding on guavas and on the fruits of *Eugenia micheli.* The eggs have also been found on the fruit of *Bixa.* Further information as to its original food-plants is required. Probably persistent hand collecting or the formation of an artificial close season for cacao fruits will be the only way to deal with this pest in the future.

Archon centaurus, Burm. (rhinoceros beetle) has been the source of much trouble on coconuts at Assuantsi. During the year, 4,033 adults were captured on 20 acres. This method of control is reported to be costly, but the results are satisfactory. The necessity for thoroughly clearing the ground before planting is emphasised.

URICH (F. W.). **Silk Culture in Trinidad.**—*Bull. Dept. Agric. Trinidad and Tobago, Port-of-Spain*, xv, no. 5, 1916, pp. 163–171, 2 figs.

This article gives an account of the history of silk cutlure in the West Indies, including experiments made with *Attacus cynthia* (Ailanthus silk worm), *Antheraea pernyi* (Chinese oak silkworm), *Telea polyphemus* (North American silkworm) and *Callosamia promethea.*

In the recent report of the Imperial Institute on samples of silk from Trinidad, it is stated that the most promising varieties were the Mulberry and Eri silk and that the latter will probably be found the better as a local industry. Before the public are advised to take up sericulture, it is suggested that some experiments should be made with the Trinidad silk moth, *Attacus hesperus*, the food-plant of which is a species of *Casearia.*

Urich (F. W.). **Notes on the South American Migratory Locusts** (*Schistocerca paranensis*).—*Bull. Dept. Agric., Trinidad and Tobago, Port-of-Spain,* xv, no. 5, 1916, pp. 172–173.

In a further report on *Schistocerca paranensis* [see this *Review*, Ser. A, iv, p. 170], it is stated that no locusts reached Trinidad until 10th June 1916, when a large swarm landed on the island of Patos. As the food conditions were not favourable owing to dry weather, the insects took wing and were driven back to Venezuela by a strong easterly wind. On 16th and 18th July another swarm landed and remained, most of the insects being destroyed by a bran mash bait. On 24th July, Patos was again invaded by a large swarm, which was dealt with in the same way.

Insect Pests in Jamaica.—*Jl. Jamaica Agric. Soc., Kingston,* xx, no. 9, September 1916, pp. 361–362.

Further investigations on the pine-apple weevil [*Metamasius ritchiei*, Mshl.] have shown that young plants and first-year pines are liable to be attacked, and that the theory that some species are immune is not likely to prove true. In August, when the adult weevils are scarce, there should be an extensive weeding out of affected pines. These should be split open so as to expose the larvae to the weather and their natural enemies. The larvae are capable of only limited locomotion, whereas if allowed to grow to maturity they can fly to fresh plants or unattacked plantations.

Two species of Cerambycid wood-boring beetles, *Cylindera flava*, F., and *Neoclytus longipes*, Drury, and a new species of Thrips, *Plectrothrips* [*pallipes*, Hood], which was found in the burrows of the former, have been bred from pieces of pimento wood. Though large numbers of these trees have died, these beetles are probably only a secondary enemy, as they appear to attack the dead wood only, and the trees had already been severely attacked by a new scale-insect, a species of *Odonaspis.*

In the Mocho district citrus trees have suffered from sooty mould following an attack of black fly, *Aleurocanthus woglumi.* As the ant, *Cremastogaster brevispinosa*, Mayr, has swarmed on these trees for years before the arrival of *A. woglumi* and as it interferes with the picking of the crop, its economic value as an enemy of the black fly is considered doubtful.

Baker (A. C.) & Turner (W. F.). **Morphology and Biology of the Green Apple Aphis.**—*Jl. Agric. Research, Washington, D.C.* v, no. 21, 21st February 1916, pp. 955–993, 4 figs., 9 plates.

The abundance and destructiveness of *Aphis pomi*, De G. (green apple aphis) in most apple-growing regions of the United States led to a careful study of its life-history being made from 1913 to 1915, the results of which are given in detail in this paper, including a diagram showing the number of lines possible from one stem-mother. The egg is laid chiefly on the tender twigs of the apple and development for a few days is very rapid, after which it rests for the winter. The egg hatches early in April and the resulting stem-mother is wingless and becomes mature in about 10 days. She gives rise to summer forms.

both winged and wingless, the former predominating. There are from 9 to 17 generations of these summer forms at Vienna, Virginia. After the second generation the wingless individuals always outnumber the others, though winged forms may occur in every generation. They become rare toward the end of the season, but a series of wingless generations may occur from the stem-mother to the egg. A third or intermediate form may also occur throughout the summer. The wingless sexes begin to appear about 1st September. They occur in all generations, from the eleventh to the nineteenth, inclusive, and probably also in the ninth and tenth. The summer wingless forms and the oviparous females, which live longer than the males, remain on the trees at Vienna until the leaves drop, usually from the middle to the end of November. Mating commences towards the close of September, one male usually pairing with more than one female. A bibliography of 19 works completes this paper.

Townsend (C. H. T.). **Some New North American Muscoid Forms.**—*Insecutor Inscitiae Menstruus, Washington, D.C.*, iv, nos. 7–9, July-September 1916, pp. 73–78. [Received 10th November 1916.]

In this paper on North American flies, a new genus, *Eubiomyia*, is erected for *Pseudatractocera calosomae*, Coq., a parasite of *Calosoma calidum*. The following new genera and species are also described :—*Ypophaemyia malacosomae*, from pupae of *Malacosoma americana* ; *Euzenilliopsis diatraeae*, from larvae of *Diatraea saccharalis*; and *Schizocerophaga leibyi*, from pupae of *Schizocerus privatus*, Norton.

Hood (J. D.). **A New** *Plectrothrips* **(Thysanoptera) from Jamaica.**—*Insecutor Inscitiae Menstruus, Washington, D.C.*, iv, nos. 7–9, July-September 1916, pp. 78–80, 1 plate. [Received 10th November 1916.]

Plectrothrips pallipes, sp. n., taken in the burrows of Cerambycid beetles boring in pimento in Jamaica, is described.

Swezey (O. H.). *Gonatocerus mexicanus*, **a Mymarid parasitic in the Eggs of** *Draeculacephala mollipes* **in Hawaii.**—*Proc. Hawaiian Entom. Soc., Honolulu*, iii, no. 3, September 1916, p. 146. [Received 10th November 1916.]

Gonatocerus mexicanus has been reared from the eggs of *Draeculacephala mollipes* in Hawaii. This species has also been reared from Jassid eggs in Mexico. The eggs of *D. mollipes* are also known to be parasitised by the Eulophid, *Ootetrastichus beatus*, and by the Trichogrammatids, *Jassidophthora lutea* and *Westwoodella caerulocephala*.

Ehrhorn (E. M.). **Contributions to the Knowledge of the Dactylopiinae of Hawaii.**—*Proc. Hawaiian Entom. Soc., Honolulu*, iii, no. 3, September 1916, pp. 231–247. [Received 10th November 1916.]

This paper gives a general account of the sub-family Dactylopiinae, with keys to Hawaiian genera and species. The following new species

are described :—*Pseudococcus straussiae,* a viviparous form found on *Straussia hawaiiensis* ; *P. swezeyi,* occurring between folded leaves of *Acacia koa* ; *P. gallicola,* forming galls on the leaves of *Santalum littorale* and *S. ellipticum* ; *P. montanus,* on *Freycinetia arnotti* and *Astelia veratroides* ; *Tylococcus giffardi,* on leaves of *Pandanus odoratissimus* ; *Trionymus insularis,* on *Deschampsia australis* and *Cynodon dactylon* ; *Ripersia palmarum,* on various palms, including *Cocos nucifera, Latania glaucaphylla, Thrynax* and *Areca lutescens* ; *Nesococcus pipturi,* gen. et sp. n., on *Pipturus albidus.*

Illingworth (J. F.). **Notes on Life-History of** *Dermestes cadaverinus,* **Fab.**—*Proc. Hawaiian Entom. Soc., Honolulu,* iii, no. 3, September 1916, pp. 255–257, 1 table. [Received 10th November 1916.]

Dermestes cadaverinus, F., has been found attacking dried specimens of the cockroach, *Rhyparobia maderae,* in Hawaii. This species has been recorded from New York, where injury was caused to silk and leather, and from New South Wales, where woollen goods were infested. The duration of the developmental stages was found to be :—larval, from 28 to 41 days ; pupal, 9 days.

McGregor (E. A.). **The Citrus Mite Named and Described for the First Time.**—*Ann. Entom. Soc. America, Columbus, Ohio,* ix, no. 3, September 1916, pp. 284–288, 2 plates. [Received 4th November 1916.]

Tetranychus citri, sp. n., collected from the leaves of lemon in Florida, is described and figured. This species also occurs in the same State on sour orange and grapefruit. In California it is a severe pest of the sweet orange, causing the dwarfing and dropping of the fruit and the discoloration and dropping of the leaves.

Girault (A. A.). **New Miscellaneous Chalcidoid Hymenoptera with Notes on Described Species.**—*Ann. Entom. Soc. America, Columbus, Ohio,* ix, no. 3, September 1916, pp. 291–308. [Received 4th November 1916.]

Among the species recorded are :—*A. perspiciosus,* sp. n., from *Aulacaspis* (*Diaspis*) *pentagona* from Japan ; *Habrocytus obscuripes,* Ashm., reared in connection with the strawberry weevil in Minnesota ; *Uscanopsis carlylei,* gen. et sp. n., from an egg-mass of *Membracis tectigera* in the British West Indies ; *Oligosita oophagus,* sp. n., from an egg-mass of a leaf-hopper on sugar-cane in Diego Martin ; *Aprostocetus whitmani,* sp. n., from eggs of *Physonota unipunctata* in Minnesota ; *Coccophagus cinguliventris,* Gir., reared from *Eulecanium* (*Lecanium*) *corni* in Wisconsin ; *Gonatocerus triguttatus,* sp. n., from an egg-mass of a leaf-hopper on orange in the British West Indies ; *Anastatus aureicorpus,* sp. n., from a ? Syrphid puparium from Texas ; *Abbella subflava,* Gir., a hyperparasite of *Polynema entettixi* on beet leaf-stems in California ; *Cheiloneurus albicornis,* How., reared from *Pulvinaria* spp. on ivy in Wisconsin and from *Physokermes piceae* on *Picea abies* ; *Ooctonus quadricarinatus,* sp. n., from limbs of pine infested with *Pityogenes hopkinsi* in New York ; *Anicetus chinensis,*

sp. n., from *Lecanium* sp., from China ; *Stigmatotrastichus emersoni*, gen. et. sp. n., from *Paraspalangia annulipes*, Ashm. ; *Roptrocerus rectus*, Prov., reared in connection with *Ips pini* in New York ; *Eupelminus coleopterophagus*, sp. n., reared in connection with the strawberry weevil in Minnesota ; *Hemaenasoidea oculata*, sp. n., reared from *Pseudococcus citri* on bamboo in Manila.

JONES (T. H.). **The Egg-plant Tortoise Beetle.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 422, 2nd October 1916, 7 pp., 3 figs.

Cassida pallidula, Boh. (the egg-plant tortoise beetle) was observed in injurious numbers in the larval stage in the spring of 1915 on the foliage of young egg-plants and potatoes at Baton Rouge, Louisiana. This beetle is somewhat widely distributed over the southern portion of the United States and also feeds on wild species of *Solanum*. The eggs are usually found singly on the under-surface of the leaves. They were first noticed in the fields on 11th May and were present as late as September. The period of incubation in the insectary during June averaged four or five days. The larval stage, in the insectary, averaged 17 days, while that of larvae caged on egg-plants in the open was 12 days. The pupal stage in the insectary averaged four to five days. The adult, which also attacks the foliage, lives in summer for several weeks and has been observed to survive for a considerable period after oviposition. The winter is passed in this stage. Under favourable conditions, it is possible that as many as five generations may occur during the year. This beetle is attacked by an undetermined egg parasite. Spraying infested plants with arsenate of lead or arsenite of zinc in the proportion of 1 pound of powder to 50 U.S. gallons of water gave satisfactory results.

A bibliography of eight works dealing with the pests of the egg-plant is appended.

ESSIG (E. O.). **The Citrophilus or Upland Mealy Bug.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, v, no. 10, October 1916, pp. 376-377.

Pseudococcus citrophilus, Claus., is unusually abundant in the San Francisco region, attacking a large number of plants. At the Mission San José the fruit, leaves, limbs and trunks of oranges and lemons were found to be covered with the egg-masses and colonies of this scale, which has also been reported from Pasadena. This species is as serious a pest as the citrus mealy bug [*P. citri*, Riss.] and should be controlled in the same way.

SMITH (H. S.) & COMPERE (H.). **Observations on the Lestophonus, a Dipterous Parasite of the Cottony Cushion Scale.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, v, no. 10, October 1916, pp. 384–390, 9 figs.

The Agromyzid fly described in this article was originally believed to be identical with the parasite described by Williston in 1888 as *Cryptochaetum* (*Lestophonus*) *iceryae*, but has recently been identified by Mr. F. Knab as *C. monophlebi*, Skuse. It is common in many parts of California and at times becomes very abundant. It appears to be

more numerous on acacia than on citrus trees and in some cases has been a more important factor in the control of *Icerya purchasi* than has *Novius cardinalis.* The adult fly and the early stages are described. Oviposition is usually effected on half-grown scales, and several eggs may be deposited in the same host. The length of the egg-stage has not been ascertained owing to the difficulty of getting the female to oviposit in confinement, but it probably lasts four to five days. Two hundred eggs may be laid by a single female. The young larva has two long tails, which are sometimes twice the length of the body, and swims about freely in the body cavity without inconveniencing the host. The mature larva is pear-shaped and the tails are enormously lengthened. In this stage it begins to destroy the tissues of the host, which takes on the characteristic convex appearance of parasitised individuals. The pupa is enclosed within the hardened contracted larval skin which forms the puparium. In the cases observed several days were required for the formation of the pupa.

There are apparently five or six generations of this parasite during the season, varying with the climatic conditions.

MASKEW (F.). **Quarantine Division. Report for the month of August 1916.**—*Mthly. Bull. State Commiss. Hortic., Sacramento, Cal.*, v, no. 10, October 1916, pp. 391–392.

The following insect pests were intercepted:—From Central America: Lepidopterous larvae in chili peppers; *Pseudococcus* sp., *Aspidiotus cydoniae, Saissetia hemisphaerica, Aspidiotus cyanophylli* and *Chrysomphalus scutiformis* on bananas. From Florida: *Coccus* (*Lecanium*) *mangiferae* on mango. From Hawaii: *Asterolecanium* sp., *Coccus* sp., and *Chrysomphalus* sp. on *Hibiscus* and oleander cuttings; *Diaspis bromeliae* and *Pseudococcus bromeliae* on pine-apples; *Hemichionaspis minor* and *Chrysomphalus aonidum* on green coconuts; weevils in bean pods. From Japan: *Aphis* sp. on lotus plants; larvae of a borer in dry plant roots; *Calandra oryzae* in rice flour; mites in bulbs. From New York: *Aphis* sp. on chrysanthemums; *Diaspis boisduvali* and *Aspidiotus britannicus* on orchids. From Philadelphia: *Aleurodes* (*Dialeurodes*) *citri, Aphis* sp. and *Pseudococcus* sp. on gardenias. From Tahiti: *Lepidosaphes beckii* on limes. From Venezuela: *Isosoma orchidearum* on orchids. From Mexico: *Chrysomphalus aonidum* and *C. aurantii* on coconuts; unidentified Lepidopterous larvae and pupae on unknown fruit; *Phthorimaea operculella* in potatoes; *Heliothis* (*Chloridea*) *obsoleta* in maize. From New Jersey: *Diaspis boisduvali* and *Coccus hesperidum* on orchids. From Oregon: *Chrysomphalus aurantii* on a rubber tree.

DAVIDSON (W. M.). **Economic Syrphidae in California.**—*Jl. Econ. Entom., Concord,* ix, no. 5, October 1916, pp. 454–457.

The majority of Syrphids in California belong to the genus *Syrphus* and prey almost exclusively on Aphids, though *Baccha lemur,* O. S., attacks mealy bugs (*Pseudococcus*) and *Sphaerophoria sulphuripes,* Thom., is predaceous on the bean thrips (*Heliothrips fasciatus,* Perg.) in Southern California. The injurious Aphids imported from Europe—e.g., *Aphis pomi,* De G., on apple, pear and loquat;

Hyalopterus arundinis, F., on prune and plum; *Aphis rumicis*, L., on beans; *Aphis medicaginis*, Koch, on leguminous crops; *Acyrthosiphon* (*Macrosiphum*) *pisi*, Kalt., on peas; *Aphis brassicae*, L., on cruciferous crops; and *Chromaphis juglandicola*, Kalt., on walnuts—have been accompanied by their Syrphid enemies, the most important being *Lasiophthicus* (*Catabomba*) *pyrastri*, L., which has been extremely abundant in central California in those years in which there has been severe infestation by Aphids. This species appears early in March, when oviposition takes place among colonies of winter-feeding Aphids, such as *Macrosiphum rosae*, L., on roses, and *M. solanifolii*, Ashm., on weeds like *Erodium*. At the end of this month eggs are laid among young colonies of orchard-infesting Aphids, the stem-mothers of which hatch from the winter eggs in February and early March. Other Syrphids which attack injurious Aphids in appreciable numbers are *Syrphus ribesii*, L., *S. torvus*, O. S., *S. americanus*, Wied., *S. opinator*, Will., *S. arcuatus*, Fall., and *Eupeodes volucris*, O. S. Of these, *S. americanus* and *S. opinator* are the two most abundant and beneficial. *S. arcuatus* occurs in early spring in the larval stage on conifers, and later principally on apples, on which it attacks *Aphis malifoliae*, Fitch. *Sphaerophoria melanosa*, Will., and *S. sulphuripes*, Thom., are also aphidophagous in the larval stage, the pupae commonly occurring on the plant on which the larvae have been living, differing in this respect from the previous species. *Allograpta obliqua*, Say, preys upon Aphids on citrus and truck crops in Southern California. Further north it is less common and has been bred from the walnut aphis, *Chromaphis juglandicola*, Kalt. *A. fracta*, a rarer species, is presumably also aphidophagous. The economic importance of *Mesograpta geminata*, Say, and *M. marginata*, Say, is unknown, while the eastern *M. polita*, Say, is injurious to maize, sometimes causing considerable damage. The larvae of *Baccha lemur*, O. S., have been bred from *Pseudococcus citri*, Risso, and other mealy bugs in Southern California. Elsewhere other species of *Baccha* have been reported as preying in the larval stage on Aphids, Coccids, leaf-hoppers and whiteflies. *Pipiza pisticoides*, Will., and *P. albipilosa*, Will., are both common in California, their larvae feeding on Aphids such as *Pemphigus populicaulis*, Fitch, on poplar. *P. modesta*, Lw., and *P. radicum*, Walsh & Riley, occur in the east upon *Eriosoma lanigerum*, Haus., and the latter also preys upon the grape phylloxera (*Phylloxera vitifoliae*). *Paragus tibialis*, Fall., and *P. obscurus*, Mg., are common and their larvae are aphidophagous, but their small size militates against their being of economic importance.

Two recently imported injurious Syrphids are *Merodon equestris*, F., (narcissus bulb-fly) and *Eumerus strigatus*, Fall., which infest onions and other bulbs. *Copestylum marginatum*, Say, and species of *Volucella* in their larval stages inhabit the interior of stems and leaves of cacti.

Syrphid larvae are often parasitised by Ichneumonid parasites belonging to the genera *Bassus*, *Syrphoctonus* and *Homotropus*, as well as by Chalcids, and at times large numbers of adults have been destroyed by fungi in central California.

In the discussion following this paper, a communication was read from Mr. H. E. Burke drawing attention to the damage done to white fir (*Abies concolor*), red fir (*Abies magnifica*) and hemlock (*Tsuga heterophylla*) by the Syrphid genus *Cheilosia*, in the larval stage.

MOZNETTE (G. F.). **The Fruit-tree Leaf Syneta, Spraying Data, and Biological Notes.**—*Jl. Econ. Entom., Concord*, ix, no. 5, October 1916, pp. 458–461, 2 plates (4 figs.)

This article contains further details as to the distribution and control of *Syneta albida*, Lec. [see this *Review*, Ser. A, iii, p. 257]. In California it is often confused with *S. simplex*, Lec. The original host-plant is not known, but the beetles have often been found attacking maple and hazelnut. As this insect did considerable damage in Willamette Valley, Oregon, in the spring of 1916, a series of spraying experiments were undertaken. Fifty Italian prunes were sprayed with Black Leaf 40 (1 : 400) and lime-sulphur (1 : 35); fifty with white hellebore, 2 lb. to 50 U.S. gallons of lime-sulphur (1 : 35); one hundred with tri-plumbic arsenate of lead 3 lb. to 50 U.S. gallons of lime-sulphur (1 : 35). A few cherry trees were also sprayed as a test for the effects of scorching. Owing to excessive rains, the first two experiments were not successful, but the last gave good results. Arsenate of lead in the usual form cannot be used in greater strength than 2 lb. to 50 U.S. gallons of lime-sulphur (1 : 35). Stronger mixtures of the tri-plumbic form than that given might possibly be used with good results. Where the fungus *Sclerotina fructigena* is also present, a combination spray should be used. If Bordeaux mixture (4 : 4 : 50) or lime-sulphur (1 : 35) be used for brown rot on prunes, plums and cherries, arsenate of lead should be added in the proportion of 3 lb. to 50 gallons of the spray, the tri-plumbic arsenate of lead being preferable. To Bordeaux mixture (4 : 4 : 50) or lime-sulphur (1 : 50), applied as a spray for brown rot just after the blossoms open, arsenate of lead in the proportion of 3 lb. to 50 U.S. gallons of the spray should be added. On apple and pear, 3 lb. of arsenate of lead to 50 U.S. gallons of lime-sulphur should be used for apple scab (*Venturia pomi*).

ESSIG (E. O.). **The Chrysanthemum Gall-fly,** *Diarthronomyia hypogaea*, **F. Löw.**—*Jl. Econ. Entom., Concord*, ix, no. 5, October 1916, pp. 461–468, 2 plates, 3 figs.

Some additional details as to this Cecidomyid are given [see this *Review*, Ser. A, iv, p. 445]. It is now reported as being very abundant and destructive in the region of San Francisco Bay. An effective control measure is to cut back the young shoots in November or December, and again in February and March, and burn the refuse. Nicotine sulphate or Black Leaf 40, in the proportion of 1 to 1,600 of water, must be used every two or three weeks from June until blossoming time. Several parasites were reared during the summer from infested plants, including a species of *Amblymerus* and another of *Tetrastichus*. A bibliography of sixteen references is appended.

DE ONG (E. R.). **Municipal Control of the Argentine Ant.**—*Jl. Econ. Entom., Concord*, ix, no. 5, October 1916, pp. 468–472.

This article reviews the work done by the city of Berkeley since 1908 in controlling the Argentine Ant [*Iridomyrmex humilis*]. A list of the towns now affected is given, showing the rapid spread of this pest, which now infests a district 700 miles long. The preparation

used against it consists of:—1 oz. white arsenic, 2 oz. sal soda or 1 oz. sodium hydroxide, mixed with 8 oz. water to which is added 16 lb. sugar and enough water to make up the whole to three U.S. gallons of syrup. In spite of what has been done, the ants continue to increase and householders are moving to uninfested localities. This failure in control is due to lack of organisation, but if undertaken by the municipality instead of being left to the individual, it should be successful.

Bridwell (J. G.). **Breeding Fruit-fly Parasites in the Hawaiian Islands.**—*Jl. Econ. Entom., Concord*, ix, no. 5, October 1916 pp. 472–476.

This article details the methods employed in breeding the Opiine Braconids introduced into Hawaii from West Africa and Australia against *Ceratitis capitata* [see this *Review*, Ser. A, iii, 412, and iv, p. 289].

In the case of *Opius humilis* it was found that the damp atmosphere caused by the fruit being enclosed on damp sand in a jar resulted in dew on the glass and formed an obviously unfavourable environment for the delicate parasites. A dry layer of sand placed in the bottom of the box and a basket formed of wire netting in which the fruit was kept separate, was found to be a much more satisfactory arrangement. Under favourable conditions it is concluded that this parasite might well eliminate the fruit fly from the thin-meated fruits such as coffee, terminalia and elengi, but in the case of fleshy fruits, such as mango, guava, peach and Chinese orange, the mechanical difficulty of parasitising the maggots would prevent the parasite from being an important factor. The author is convinced that under Hawaiian conditions, *C. capitata* must be controlled by the use of parasites to reduce the flies to the point where poisoned baits will be effective.

Smith (H. S.). **An Attempt to redefine the Host Relationships exhibited by Entomophagous Insects.**—*Jl. Econ. Entom., Concord*, ix, no. 5. October 1916, pp. 477–486.

Entomophagous insects are usually divided into two classes, parasitic and predaceous, according to their method of feeding, though there is no definite division between them. For example, the female *Scutellista cyanea* deposits its eggs beneath the adult black scale [*Saissetia oleae*] and the resulting larva feeds upon the eggs of the host, of which it requires a large number, frequently several hundreds, to complete its development, although it always matures beneath a single scale. The usually accepted definition of a parasite might therefore be enlarged by describing it as an entomophagous insect which requires but a single individual host, or the eggs of a single individual, to complete its development. Other insects on the border line between parasites and predators are:—*Macrorileyia oecanthi*, Ashm., a Chalcidoid found living in the pith of twigs in which tree-crickets have laid their eggs, upon which it feeds, and *Aphelinus mytilaspidis*, which is both parasitic and predaceous, feeding either upon the adult or its progeny.

The inter-relationship of the parasites themselves is also considered. Hyperparasitism denotes any stage of parasitism other than primary, though a parasite of a predaceous insect, such as a Coccinellid, is not a hyperparasite. Indirect parasitism is defined as "that type of symbiosis in which the one parasite attacks a host-insect upon which it is itself incapable of breeding for the sake of the primary parasite that it may harbour." *Perilampus hyalinus* is cited as an example among the Chalcidoids and *Mesochorus pallipes* among the Ichneumons.

True secondary parasitism, which is of very common occurrence in nature and of great importance in the natural control of insects, is defined as that type of symbiosis where a parasite destroys a primary parasite by direct attack and not through the medium of the host of the primary parasite. This type is very important in the control of injurious insects, and the introduction of these secondary parasites must be guarded against when introducing beneficial insects. The newly introduced parasite may also be attacked by secondary ones indigenous in the locality, which had as their original host species of the same genus as the parasite introduced. This has occurred in the case of *Apanteles fulvipes,* introduced against the gipsy moth (*Lymantria dispar*). Tertiary and quaternary parasitism, which are stages of parasitism beyond that of secondary, are not of common occurrence. The latter has been recorded, but is probably accidental. The former occurs in the case of the Eulophid, *Asecodes albitarsis,* which generally breeds upon *Dibrachys boucheanus,* which is a true secondary parasite.

Super-parasitism is defined, according to Fiske, as the form of symbiosis resulting when any individual host is attacked by two or more species of primary parasites or by one species more than once, though the author considers that this term should be restricted to cases where there is a superabundance of parasites of a single species, using the term multiple parasitism for cases where the same individual host is infested simultaneously with the young of two or more different species of primary parasites.

Quayle (H. J.). **Dispersion of Scale Insects by the Wind.**—*Jl. Econ. Entom., Concord,* ix, no. 5, October 1916, pp. 486–492, 1 fig.

That young individuals of the black scale (*Saissetia oleae*) are carried by the wind has been proved by a series of experiments with tanglefoot sheets put out on 28th June 1915, when in different situations and at distances ranging from 10–450 feet from infested trees, a total of 7,262 scales were captured. The young individuals of the red scale, *Chrysomphalus aurantii,* were captured in a similar manner at distances ranging from 6–150 feet from infested trees. As a proof that living as well as dead scales may be carried by the wind, a four acre grape-fruit orchard was fumigated in 1914. In April 1915, no black scale could be found, but by midsummer young individuals were present, which must have come from neighbouring infested trees growing on the west, south and east sides of the orchard. A diagrammatic table shows that the spread of the scale followed the direction of the prevailing wind. This was corroborated by another series of experiments performed with tanglefoot sheets exposed on barren ground at varying distances from infested branches removed from the trees. In the case of *S. oleae* dispersion by the wind occurs chiefly while the young are emerg-

ing from April to September, but in the case of scales having three or four generations a year, the period is prolonged. Though the experiments described only record a dispersal up to 450 feet, it may take place over a much greater distance. The practical importance of carrying on fumigation work over as large an area as possible is thus emphasised.

ROCKWOOD (L. P.). *Sporotrichum globuliferum*, **Speg., a Natural Enemy of the Alfalfa Weevil.**—*Jl. Econ. Entom., Concord*, ix, no. 5, October 1916, pp. 493–499.

The fungus, *Sporotrichum globuliferum*, was first found infesting the alfalfa weevil [*Hypera variabilis*] near Salt Lake City, Utah, on 14th March 1914, the time of its greatest abundance being from 21st–29th April. The death of the adults at this time, *i.e.*, before and during oviposition, is of considerable importance, as it helps to reduce the destructive new generation of larvae when no other natural enemy of importance has been observed. The weevils are specially exposed to infection in early spring, when optimum conditions for the fungus occur and the insect is frequenting the ground. The macroscopic appearance of the fungus found on weevils killed by it differs from that found on those infested after death from some other cause. Weevils killed by the fungus are usually found in a life-like attitude with legs and antennae extended. In a series of eight laboratory experiments it was found that the resistance to infection by the weevils is considerable, when the conditions most closely approach the natural ones.

Experiments made with *Metarrhizium anisopliae* showed a 50 per cent. less mortality among the weevils treated under similar conditions than in the case of *S. globuliferum*.

MAXON (A. C.). **Some unpublished Notes on** *Pemphigus betae*. **Doane.**—*Jl. Econ. Entom., Concord*, ix, no. 5, October 1916, pp. 500–504.

Some additional facts in the life-history of this Aphid are given [see this *Review*, Ser. A, iii, pp. 351–578]. By digging in old beet-fields it was found that considerable numbers of the apterous form survive the winter in the soil. Apterous forms also occur on *Achillea* sp., *Aster multiflora*, *Solidago* sp., *Rumex* sp., *Agropyron* sp., and *Polygonum aviculare*; though, as the different species of the genus *Pemphigus* cannot at present be distinguished in this stage, some of these may not be food-plants of *P. betae* itself. Summer colonies were found on the roots of *Chenopodium album*, garden beets, sugar beets, and *Cycloloma atriplicifolium*. Since the reduction of the percentage of sugar in beets is of vital interest to the sugar manufacturer, a series of tests were made to ascertain the effect of this Aphid in this respect. These showed that the yield of beet was reduced by 2·25 tons per acre where about half the crop was infested, while infested samples contained nearly 1 per cent. less sugar than the uninfested. Spring irrigation has been proved to be the most effective method of control.

The natural enemies include the larvae of a Syrphid fly and a Capsid, which prey on the lice while in the galls, and the fungus

Empusa aphidis, which destroys many lice in the soil. The larva of *Syrphus pauxillus* has been found feeding on a colony on beet, and the larvae of the Coccinellids, *Scymnus collaris, Hippodamia convergens* and *Scymnus appaculus* [? *appalacheus*, Casey] also attack it. The life-cycle has been followed in the insectary from the gall to the gall and shows that *Pemphigus balsamiferae*, Williams, is a synonym of this species. *P. betae* is liable to be confused with *P. p-venae*, Fitch, and *P. p-globuli*, Fitch, from which it differs chiefly in the form and position of the galls. *P. betae* has not been recorded east of western Kansas and Nebraska, but it is probable that its range coincides with that of its alternative host, the narrow-leafed cottonwood (*Populus angustifoliae*), the range of which is given as from North Dakota to Washington and from New Mexico to California.

McGregor (E. A.). *Bucculatrix thurberiella*, **a Pest of Cotton in the Imperial Valley.**—*Jl. Econ. Entom., Concord*, ix, no. 5, pp. 505–510, 2 plates (5 figs.), 2 tables.

The life-history of *Bucculatrix thurberiella*, found attacking the leaves of cotton in June 1916 in the Imperial Valley, California, is described. In a heavily infested field examined on 2nd June only 22 per cent. of the leaves were free from attack, and later on the percentage of infestation was greater still, but by 1st July was somewhat checked by the work of parasites. By 8th August, however, the damage had increased, until in some fields not a leaf was undamaged. The moth appears to prefer small and weakly plants, which are usually killed by it, larger ones being severely damaged. It is parasitised by two species of undetermined Chalcids. The question as to whether *Thurberia* or cotton (*Gossypium*) is the original native host-plant is as yet uncertain, but it was noticed that *Gossypium* became infested early, while *Thurberia* growing in the immediate neighbourhood remained free for weeks. The stockade of bristles placed by the mature larva round the cocoon closely simulates the hirsute pubescence found on the stems and petioles of most cultivated varieties of cotton, though this does not occur on *Thurberia*. On the whole it is considered probable that this pest has entered the United States from the ancient cotton-growing areas of Mexico and from the insular and maritime regions of tropical America.

Urbahns (T. D.). **Life-History of** *Habrocytus medicaginis*, **a recently described Parasite of the Chalcis Fly in Alfalfa Seed.**—*Jl. Agric. Research, Washington, D.C.*, vii, no. 4, 23rd October 1916, pp. 147–153, 1 plate, 1 fig.

This article contains a detailed description of the stages in the life-cycle of *Habrocytus medicaginis*, a parasite of *Bruchophagus funebris*, How., which latter completes its development within the growing seeds of lucerne, red clover (*Trifolium incarnatum*) and wild species of *Medicago*. This parasite never attacks the pupa of *B. funebris* and only a single individual is able to develop on its host in a single seed. It has never been found parasitising *B. funebris* in red clover seed. The number of males is usually small, those reared being in the ratio of 1 : 30 as com-

pared with the females. In western Arizona and southern California, *H. medicaginis* appears in the adult stage as early as March and is most numerous during June and July on irrigated lucerne fields. There may be from one to five generations in a single season. It hibernates in the larval stage within the infested seeds, but the undeveloped larvae and individuals in the pupal stage are usually killed by the first severe frost. In southern California occasional examples hibernate in the pupal stage. The rate of parasitism by *H. medicaginis* varies from 0·8 per cent. to 4·9 per cent. in various parts of California and Arizona.

McDunnough (J.). **On the Types of Certain Noctuid Genera occurring in North America (Lepid).**—*Entom. News, Philadelphia*, xxvii, no. 9, November 1916, pp. 393–400.

This paper draws attention to the fact that in the Catalogue of the Lepidoptera Phalaenae of the British Museum, Sir George Hampson has adopted as the type of each genus, when not specified by the author, the *first species* placed under the generic name, regardless of the work of previous entomologists. Though personally inclined to favour this principle, the author points out that it is not in accordance with the views of the great majority of systematists and cannot be accepted according to the current rules of nomenclature. Some changes in the generic names of several North American species of economic importance are therefore involved. These include :—

Chloridea (Hmp.)	=	*Heliothis*, Ochs.
Hadena (Hmp.)	=	*Neuria*, Gn.
Parastichtis (Hmp.)	=	*Septis*, Hb.
Athetis (Hmp.)	=	*Caradrina*, Ochs.
Eriopus (Hmp.)	=	*Callopistria*, Hb.
Hydroecia (Hmp.)	=	*Gortyna*, Ochs.
Gortyna (Hmp.)	=	*Helotropha*, Led.
Phragmatiphila, Hmp.	=	*Nonagria*, Ochs.
Nonagria (Hmp.)	=	*Senta*, Steph.
Gonospileia (Hmp.)	=	*Euclidia*, Ochs.
Mocis (Hmp.)	=	*Pelamia*, Gn. (*Remigia*, Gn.)*

Van Dyke (E. C.). **New Species of Buprestidae (Col.) from the Pacific States, with Notes concerning a few others.**—*Entom. News, Philadelphia*, xxvii, no. 9, November 1916, pp. 405–412, 1 fig.

Chrysobothris pseudotsugae, sp. n., from California, on Douglas fir (*Pseudotsuga taxifolia*) and white fir (*Abies concolor*), and *Chrysobothris laricis*, sp. n., on western larch (*Larix occidentalis*) and on lodge-pole pine (*Pinus contorta* var. *murrayana*) in Oregon, are among the new Buprestids described in this paper.

*[As the system adopted by Sir George Hampson is in direct conflict with the fundamental principles upon which zoological nomenclature is based, the emendations in the generic names suggested in this paper will in future be adopted in this *Review*.—Ed.]

Rich (S. G.). **Notes on** *Zonocerus elegans*, **Burm. (Orthop.)**—*Entom. News, Philadelphia,* xxvii, no. 9, November 1916, pp. 420–421.

This is a popular account of *Zonocerus elegans*, Burm., which is a very common grasshopper in the coast and central districts of Natal, where it is a pest of sugar-cane and in gardens.

Marre (E.). **L'Attelabe curculionide.** [*Attelabus nitens.*]—*Progrès Agric. Vitic., Montpellier,* lxvi, no. 44, 29th October 1916, pp. 427–428.

Attelabus nitens, Scop., was recorde don chestnut trees in various places in France in June 1916. The leaves of chestnuts attacked by this insect are rolled for half or three-quarters of their length and resemble vine leaves attacked by *Byctiscus betulae* (*Rhynchites betuleti*), a badly infested tree presenting the appearance of having been burnt.

Labitte (A.). **Longévité de quelques Insectes en captivité.** [Longevity of certain Insects in Captivity.]—Separate from *Bull. Muséum d'Hist. Nat., Paris,* no. 2, 1916, 9 pp.

This paper gives some remarkable details as to the longevity of a number of Coleoptera in captivity.

The following table gives the average period of existence in days of both sexes :—

	Males.	Females.
Procrustes	374·10	338·20
Carabus	323·20	385·71
Necrophorus	232·33	291·50
Dytiscus	853·66	740·00
Hydrophilus	164·66	374·00
Melolontha melolontha (*vulgaris*)	19·20	26·81
Cetonia aurata	57·50	88·00
Lucanus cervus	19·16	31·72
Dorcus	327·00	375·33
Ateuchus	338·25	466·80
Sisyphus	198·40	266·50
Copris	496·55	623·44
Geotrupes	700·06	642·14
Oryctes	37·50	55·50
Blaps mortisaga	848·20	914·40
Blaps gigas *Blaps magica* *Blaps edmondi*	700·00	727·66
Akis	854·40	951·42
Pimelia	669·08	714·18
Timarcha	135·00	181·66

Another table gives the maximum period of existence, viz :—

	Days.		Days.
Cicindela campestris ..	182	*Sisyphus schaefferi* ..	361
Procrustes coriaceus ..	697	*Copris hispanus*	1,137
Carabus auratus	1,112	*Copris lunaris*	344
Carabus monilis	431	*Geotrupes stercorarius* ..	1,137
Carabus festivus	411	*Geotrupes sylvaticus* ..	361
Carabus morbillosus ..	421	*Geotrupes typhaeus* ..	329
Carabus hispanus	328	*Geotrupes mutator*	824
Carabus intricatus ..	343	*Oryctes nasicornis*	68
Carabus nemoralis ..	261	*Blaps gigas*	3,349
Carabus cancellatus ..	123	*Blaps mortisaga*	1,219
Carabus purpurescens ..	143	*Blaps magica*	1,168
Carabus lotharingus ..	416	*Blaps edmondi*	1,106
Sphodrus leucophthalmus ..	273	*Akis spinosa*	1,115
Scarites gigas	288	*Akis reflexa*	1,109
Ocypus olens	161	*Pimelia angulata*	918
Necrophorus vespillo ..	322	*Pimelia inflexa*	910
Dytiscus marginalis ..	1,005	*Pimelia depressa*	989
Hydrophilus piceus ..	613	*Pimelia cribripennis* ..	912
Melolontha melolontha ..	31	*Adesmia microcephala* ..	352
Cetonia aurata	196	*Timarcha tenebricosa* ..	288
Lucanus cervus	196	*Dorcadion fuliginator* ..	66
Dorcus parallelipipedus ..	395	*Cerambyx heros*	73
Ateuchus sacer	633	*Cerambyx cerdo*	95
Ateuchus semipunctatus ..	392	*Mecaspis tigrinus*	114

African Wild Silk. –*Bull. Imp. Inst., London,* xiv, no. 2, April-June 1916, pp. 167–180.

The only silkworms of importance found in a wild state in Africa belong to the Notodontid genus *Anaphe.* The chief species occurring in British territory are *A. infracta* in Nigeria and Uganda ; *A. venata* in Nigeria and the Gold Coast ; *A. moloneyi* in Nigeria ; *A. ambrizia* in Uganda ; *A. panda* and *A. reticulata* in Natal. The existing methods of collection, cleaning and exportation of the product involve so much time and expenditure as to render the success of the industry very doubtful. If, however, the cost of production were reduced by domesticating the silkworm, which can be done successfully, and all chrysalises, twigs, etc., removed from the silk by native labour, the clean product could then be compressed in bales for export, and if carried out on a sufficiently large scale, there seems to be no reason why a new industry, contributing to the welfare of several British African possessions, should not be established.

McIndoo (N. E.). **Effects of Nicotine as an Insecticide.**—*Jl. Agric. Research, Washington, D.C.,* vii, no. 3, 16th October 1916, pp. 89–122, 3 plates.

Owing to the high price of nicotine attempts have been made to find a substitute for it, and in order to do so, its physiological effects as an insecticide must be studied. The following investigations were carried out with this object. The method followed was to compare

treated insects with normal ones, and immediately after death, to fix treated individuals in a fluid containing a nicotine precipitant.

Nicotine as a stomach poison was tested on bees, which were fed on 10 cc. of a mixture of nicotine with honey (1 : 100). Death ensued in 33 hours on an average, whereas bees fed on pure honey lived on an average for eight days. The effect of the poison was to cause paralysis.

The next experiments deal with nicotine in spray solutions. When leaves of Carolina poplar (*Populus deltoides*) bearing *Aphis populifoliae*, Davis, were dipped in a solution of pure nicotine (1 : 100), all the Aphids were dead in half an hour. On leaves sprayed with the same solution, nearly all the Aphids died in from 30–45 minutes. When leaves bearing Aphids were sprayed with a solution of nicotine sulphate (1 : 64), they all died within four hours. With the same solution, the large caterpillars of the catalpa sphinx (*Ceratomia catalpae*, Bdv.) died in an hour and smaller ones sprayed with a much weaker solution (1 : 1,200) died in 5 minutes. An extract of 50 gms. of tobacco boiled in 1,000 cc. of water gave a similar result. Small caterpillars of *Atteva aurea*, Fitch, and of *Datana* sp. were quickly killed by the stronger nicotine sulphate solution, but the larger larvae of the lesser wax moth (*Achroia grisella*, F.) and of the bag-worm, *Thyridopteryx ephemeraeformis*, Haw., showed greater resistance. Three out of four adult blister beetles (*Epicauta pennsylvanica*, DeG.) thus sprayed, also died, but worker bees could not be killed by spraying.

For testing nicotine as a fumigant, a special apparatus was used. A piece of rubber tubing 12 inches in length with its free end projecting into a battery jar 9 inches in diameter and 12 inches high was connected to the neck of a 55 cc. retort supported on a ring stand. The jar was covered with a piece of glass. Twenty-five cc. of pure nicotine placed in the retort was heated, and when the whole apparatus was sufficiently warm to prevent recondensation, the free end of the tubing was inserted into the battery jar containing the specimens to be experimented upon. On removing the burner, the nicotine condensed as a fine spray on the leaves, insects and sides of the jar. In the case of Carolina poplar leaves bearing *Aphis populifoliae* and nasturtium leaves bearing *Aphis rumicis*, L., all the Aphids were dead within five minutes. When a 40 per cent. solution of nicotine sulphate was substituted, the Aphids on nasturtiums, as well as *Myzus persicae*, Sulz., on potatoes, and the scale, *Orthezia insignis*, Dougl., died within a few minutes, though the plants were also considerably affected; caterpillars of the fall webworm (*Hyphantria cunea*, Dru.) and larvae of potato beetles (*Leptinotarsa decemlineata*, Say) died only after being confined in dense fumes from 15 to 20 minutes. Worker honey bees die in the same length of time, but the adults of *Musca domestica*, L., do not die so readily. Bees apparently dead may recover when removed to fresh air.

Several other experiments with nicotine odour and vapour were made, the same forms of nicotine being used. *Aphis populifoliae* placed on Carolina poplar leaves previously dipped in pure nicotine solution and thoroughly dried, were dead within 24 hours, though none of the Aphids used as controls died. Examples of *Aphis brassicae* placed on wire screens over watch-glasses containing pure nicotine solution (1 : 100), died in from 10 to 22 minutes. Extensive experi-

ments were also made in tracing the nicotine into the tissues, on the ability of coloured liquids containing nicotine to enter the spiracles and alimentary canal, the effect of nicotine as a stomach poison on the tissues and as a fumigant on the nervous system.

The microscopical examination of the various insects and their tissues is described in detail, and the following conclusions are arrived at:—Nicotine spray solutions do not enter the spiracles, nor do they pass through the integument of insects. Nicotine as a stomach poison seems to be distributed to all the tissues, including the nervous system. Nearly all the nicotine fumes that strike the integument and pass into the tracheae are immediately condensed and these are consequently more or less covered with a fine spray, which is well distributed through the many small tracheal branches to all the tissues, some passing into the cells. The nervous system receives its quota of the fine spray and vapours from the spray, which immediately paralyse the nerve cells, this explaining how odoriferous particles and vapours from nicotine spray solutions kill insects by paralysis.

A historical review of nicotine, with descriptions of its pharmacological effect on various classes of animals and its physical and chemical effects on living cells is given, and the article closes with a bibliography of 25 works of reference.

BORODIN (D. N.). **О нахожденіи двухъ яйцеѣдовъ въ окрестностяхъ г. Ставрополя-Кавказскаго.** [On the Discovery of two Egg-parasites in the Environs of Stavropol.]—**«Любитель Природы.»** [*Friend of Nature*], *Petrograd*, xi, no. 5, May 1916, pp. 126–129, 3 figs. [Received 22nd November 1916.]

This note reports the discovery near Stavropol of two egg-parasites, *Trichogramma semblidis*, Aur., and *Aphanurus* (*Telenomus*) *semistriatus*, Nees. The first-named was observed to attack the eggs of *Barathra* (*Mamestra*) *brassicae* and, to a less degree, those of *Pieris rapae*. The development of the parasite in the laboratory lasted 15 days. *A. semistriatus* was reared from eggs of a bug, *Eurygaster integriceps*, Osh. The parasites were fed in captivity on syrup and survived for five months, during which they were carried in a test-tube from Stavropol to Kiev and back, and thence to Petrograd. They did not attack eggs of *Eurydema ornatum*, L. Although *E. integriceps* was present in 1913 in very large numbers in other parts of the government of Stavropol, it was not numerous in the environs of the town of that name, probably owing to the presence of this parasite.

MEIER (N. F.). **Къ біологіи подсолнечнаго усача.** [On the Biology of *Agapanthia dahlii*, Richt.]—**«Любитель Природы.»** [*Friend of Nature*], *Petrograd*, xi, no. 6–7, June & July 1916, pp. 150–159, 11 figs. [Received 22nd November 1916.]

The Longicorn, *Agapanthia dahlii*, the life-history of which is very little known, is a serious pest of sunflowers, and frequently destroys whole fields in Russia. The insect winters as a mature larva in the stem below the surface of the ground and pupates early in spring. The pupal stage lasts about two weeks, the first beetles having been observed in the open on 1st June. According to Schreiner, in the

more northerly government of Saratov, this stage lasts four weeks. The process of oviposition was not observed, but, though Schreiner has stated that the female deposits her eggs on the stem into which the larva bores, the author believes that the female gnaws an opening in the wall of the stem and prepares a cell in which it lays one or sometimes two eggs. Oviposition takes place in the second part of June and the larvae appear in the first half of July. The larvae usually mine downwards and become mature in the first half of September. The only remedy is to dig out the plants, roots and all, and destroy them by burning; this must be done in autumn or early in spring in order to kill the hibernating larvae.

PLIGINSKY (V.). **Опредѣлитель русскихъ кожеѣдовъ.** [Key to the Identification of Russian DERMESTIDAE.]—**«Любитель Природы.»** [*Friend of Nature*], *Petrograd*, xi, no. 6–7, June-July 1916, pp. 159–170.

This key to the Dermestids deals with the species in the following genera:—*Dermestes*, L.; *Montandonia*, Jaquet; *Attagenus*, Latr.; *Megatoma*, Hbst.; *Globicornis*, Latr.; *Phradonoma*, J. Duv.; *Trogoderma*, Latr.; *Ctesias*, Steph.; *Anthrenus*, F.; *Trinodes*, Latr.; and *Orphilus*, Fr.

GORIAINOV (A.). **Опыты съ нѣкоторыми растительными и минеральными инсектисидами.** [Experiments with some Vegetable and Mineral Insecticides.]—**«Защита растеній отъ вредителей.»** [*The Protection of Plants from Pests*], Supplement to **«Любитель Природы.»** [*Friend of Nature*], *Petrograd*, 1916, no. 1–2 (28–29), pp. 1–28. [Received 22nd November 1916.]

The experiments described in this paper were carried out at the Entomological Bureau of Riazan during 1915. The rise in price of the more commonly used insecticides and fungicides, which has taken place since the beginning of the War, induced the Bureau to experiment on some vegetable decoctions with a view to replacing the more expensive and, in some cases unobtainable, mineral insecticides. The method of investigation consisted of feeding the insects, kept either in wire cages or in glass vessels covered with gauze, on food-plants moistened with the various decoctions, the food being changed every day. The decoctions were roughly prepared by drying the plants for some days in the open, and then chopping them up and boiling them with water for from three to five hours in an earthenware or iron vessel. Before boiling, the plants were weighed and the quantity of the strained decoction was afterwards measured. Decoctions of different strengths of wormwood (*Artemisia absinthium*) were tried on caterpillars of *Aporia crataegi*, *Vanessa urticae*, and *Pieris brassicae*, but the results were not satisfactory, except in combination with poultry dung, when it was more effective. The extract in this case was prepared as follows:—A young plant was dried in the open for three days and then chopped up and boiled for $2\frac{1}{4}$ hours, by which means 290 cc. of the decoction were obtained from 50 grms. of the plant; 125 gms. of poultry dung was extracted separately in a tumbler of water for 10 hours; 50 cc. of the wormwood decoction

and 50 cc. of the strained dung extract were then mixed in 100 cc. of water. A decoction of swallow-wort (*Chelidonium majus*) caused a death-rate of 4 per cent. in *Malacosoma neustria* and of 44 per cent. of in *Vanessa urticae*. A decoction of chamomile (*Matricaria discoidea*) proved quite ineffective. Henbane (*Hyoscyamus niger*) was responsible for a death-rate of 76 per cent. in *M. neustria*, of 45 per cent. in *V. urticae*, and 100 per cent. in *Pteronus ribesii* (*Nematus ventricosus*).

A decoction of spurge (*Euphorbia* sp.) caused a death-rate of 38 per cent. in *M. neustria*, which would probably have been higher, but for the fact that 20 per cent. of the caterpillars pupated during the experiment. A decoction of white hellebore (*Veratrum album*) gave insignificant results, as also did a decoction of tomatoes (*Lycopersicum esculentum*, L.); in the case of the last, the result, which is at variance with statements of other authors as regards its effect on *Pieris brassicae*, may probably be attributed to the weakness of the extract. Decoctions of tobacco (*Nicotiana rustica*) and quassia (*Quassia surinamensis*) are well known as contact poisons, and experiments on these lines also showed that they are effective as stomach poisons. Tobacco decoction prepared by boiling 1 lb. of tobacco in 3 gals. of water and diluting the strained liquid in another 6 gals. of water, produced a death-rate amongst caterpillars of *P. brassicae* as high as 62·5 per cent. Quassia decoction (3 lb. of quassia in 6 gals. of water boiled down to half the original volume, strained and mixed with 2 lb. of soft soap and, before use, diluted in about 8 gals. of cold water) produced the same high death-rate among the caterpillars of *P. rapi* and *Barathra* (*Mamestra*) *brassicae*. Another experiment, in which the decoction was not diluted with water before use, gave a still higher death-rate.

Some experiments were also made with mineral insecticides. Acid chromate of lead, about 2 oz. in 4 gals. of water, gave unsatisfactory results on caterpillars of *A. crataegi* and *M. neustria*, though a stronger solution of 2 oz. in 3 gals. gave varied results, the death-rate being higher amongst caterpillars of *M. neustria* (32–40 per cent.) than among those of *P. brassicae* (12·5 per cent.). "Galiatzin," which is a new commercial preparation, gave very poor results. Lead arsenate, both commercial and home-made, gave excellent results, the death-rate amongst caterpillars of *M. neustria* being 100 per cent. A mixture of common salt and lime, as recommended by Professor N. Kulagin (3 parts by weight of salt and 2 parts of lime in 100 parts of water), gave a death-rate of 34 per cent. amongst caterpillars of *P. brassicae* and deserves further attention. Paris green, which, according to some authors, is ineffective against caterpillars of *P. brassicae* and is insufficiently adhesive, caused a death-rate among these caterpillars of 91·1 per cent. To make it adhesive, soft soap (1 oz. of green, 1 oz. of lime, $\frac{1}{4}$ lb. of soap in 6 or 7 gals. of water) should be used in preference to molasses. White arsenic (7 lb. of arsenic boiled until dissolved with 2 lb. of common soda, with 3–5 lb. of quick lime added and boiled for another 1–2 hours, the whole being diluted with 180 gals. of water) caused a death-rate of 80 per cent. among caterpillars of *A. crataegi*. "Mortus," a new preparation of unknown composition, but probably containing sodium arsenate, is very effective, and has been introduced as a fungicide; in the proportion of 1 lb. in about 145–150 gals. of water it proved an excellent remedy against caterpillars of *M. neustria*, resulting in a death-rate of 100 per cent.; it

was also tried in nature against the gooseberry sawfly (*Pteronus ribesii*) with great success; the disadvantage of this insecticide is its high price.

The results of these experiments are summarised by the author as follows: Vegetable decoctions are quite practicable as insecticides and never cause any scorching. Their disadvantages consist in their rapid fermentation, to prevent which they must be prepared directly before use with the addition of some soda. Even weak vegetable insecticides are of some value, as they lower the vitality of caterpillars feeding on plants sprayed with them. They are considered to be deserving of serious attention and to offer a wide field for further investigation.

Dobrodeiev (A. I.). **Блѣдноногій вишневый пилильщикъ и борьба съ нимъ.** [*Priophorus padi*, L., and its Control.]—**« Защита растеній отъ вредителей.»** [*The Protection of Plants from Pests*], Supplement to **« Любитель Природы.»** [*Friend of Nature*], *Petrograd*, 1916, no. 1–2 (28–29), pp. 38–44, 5 figs.

The sawfly, *Priophorus padi*, L. (*Cladius albipes*, Eversm.) injures cherry, plum and service trees; it is found also on blackthorn, birch, medlar, bird cherry, roses, dewberry and raspberry. In the government of Kiev it has done serious damage in the orchards. The females oviposit in spring on the central vein of the leaf on its lower side. The larval stage lasts three weeks. According to Theobald, pupation takes place in the soil, but the author doubts the accuracy of this statement, pupation usually taking place, in his experience, beneath leaves or other debris on the ground. The insect hibernates as a mature larva and two or three generations occur during the summer. The larvae are attacked by parasites, including the Tachinid, *Ptychomyia selecta*, and the Chalcid, *Dibrachys boucheanus*, Thoms., while, according to Theobald, they are also infested by the Ichneumons, *Ichneutes reunitor*, Nees, and *Tryphon lucidulus*, Grav. It is probable that infestation by *P. selecta* does not take place through actual oviposition on the skin of the host, but by the host swallowing the eggs of the parasite deposited on its food-plants. Similar phenomena are known in the case of other Tachinids, such as *Phryxe vulgaris* (*Blepharidea scutellaris*) and *Crossocosmia sericariae*. *Dibrachys boucheanus* is probably a hyper-parasite. The remedies against this pest include:—Spraying with Paris green and the removal and burning of the debris on the ground round the trunks.

Sokolov (N.). **Озимая совка, по наблюденіямъ лѣтомъ 1915 г. въ Тамбовской губерніи.** [*Euxoa* (*Agrotis*) *segetum*, L., and *Feltia exclamationis*, Schiff., in the govt. of Tambov in the Summer of 1915.]—**« Защита растеній отъ вредителей.»** [*The Protection of Plants from Pests*], Supplement to **« Любитель Природы.»** [*Friend of Nature*], *Petrograd*, 1916, no. 3 (20), pp. 1–15.

This is a report on observations made by the author jointly with N. F. Meier and I. I. Voskoboinikov, during the summer of 1915 in the government of Tambov. Large outbreaks of Noctuid caterpillars occurred in the Borisogliebsk district of the government in the autumn of 1911 and spring of 1912 and again in 1913–14, when large

areas of crops were destroyed, and it was feared that another outbreak might occur in 1915. The predominant species was *Euxoa segetum*, while *Feltia exclamationis* occurred in smaller numbers, and several other species were present. Digging operations that were started on 1st May and continued till 17th June revealed the presence of both larvae and pupae. Towards the end of this time the insects were already mostly on the wing and were collected by means of molasses-troughs, the maximum number being caught early in June. The males were more numerous than the females, and this fact, combined with the unfavourable weather conditions, led to a very small oviposition and only very few eggs or caterpillars were subsequently found in the open. The great number of parasites earlier in the season infesting the caterpillars and pupae of the first generation also contributed to this. About 70 per cent. of them were infested with the Ichneumon, *Amblyteles vadatorius*, and they were also attacked by a Braconid, *Macrocentrus ? collaris*, and another Ichneumon, *Ophion luteus*, as well as Tachinids. *A. vadatorius* was in its turn attacked by a Dipterous hyperparasite to the extent of 14·3 per cent. The caterpillars also suffered from bacterial and fungous diseases. The scarcity of caterpillars in this district put an end to any further observations, but investigations in another part of the government showed that a second generation was on the wing in August, the numbers of which greatly exceeded those of the first. A series of tables and a diagram showing the numbers of adults captured are given.

Kolossov (J. M.). **Очеркъ о вредителяхъ Урала, наблюдавшихся въ сельскомъ хозяйствѣ.** [Review of Pests of Agriculture in the Ural.]—**«Записки Уральскаго Общества Любителей Естествознанія.»** [*Bulletin de la Société Ourallienne d'Amis des Sciencse Naturelles*], *Ekaterinburg*, xxxvi, no. 14, 1916, pp. 45–58.

This is a summary of replies to a circular letter sent out by the Ural Society of Friends of Natural Science in the spring of 1915, similar to a former one [see this *Review*, Ser. A, iii, p. 398]. The returns cover the governments of Perm, Ufa and Orenburg, and the province of Turgai. Locusts were present only in small numbers in Perm, chiefly owing to the rainy spring and summer of 1915 and to the frosts which occurred in May. Large outbreaks took place in some districts of this government in 1887–1890, 1891–92, 1901–1902, and in some years the damage done, coupled with droughts, was responsible for famine. In Orenburg they were more numerous and injurious, the most important species being *Bryodema tuberculatum*, F., *Arcyptera flavicosta*, Fisch., and *Gomphocerus sibiricus*, L. In one district the campaign against them cost the Zemstvo some £700, sodium arsenite having been used, which gave a death-rate of 95 per cent. Insect parasites were also of assistance in reducing their numbers. Other species reported were :—*Stenobothrus nigromaculatus*, H.-S., *S. albomarginatus*, De G., *Dociostaurus* (*Stauronotus*) *brevicollis*, Ev., *Arcyptera fusca*, Pall., *Celes variabilis* var. *subcaeruleipennis*, *Podisma pedestris*, L., and *Locusta* sp.

Mayetiola destructor, Say, was present on winter fields in some parts of the government of Perm without causing great damage ; *Apamea* (*Hydroecia*) *nictitans*, L., and some other Noctuidae were present in

small numbers. In one district an unidentified beetle injured peas and vetches. *Phyllotreta horticola*, L., attacked vegetables, and *Lymantria* (*Ocneria*) *dispar*, L., was reported from several forests in Perm and Orenburg.

Kolossov (J. M.). **Матеріалы къ познанію Энтомофауны Урала.** [Materials for the Study of the Insect-Fauna of the Urals.]—**«Записки Уральскаго Общества Любителей Естествознанія.»** [*Bulletin de la Société Ourallienne d'Amis des Sciences Naturelles*], *Ekaterinburg*, 1916, xxxv & xxxvi, nos. 11–12 & 1–4, pp. 239–244 & 61–64.

These are two further instalments of the same series by this author [see this *Review*, Ser. A, iii, pp. 6 and 727], the first being a supplement to the list of Coleoptera of the government of Perm, and the second a supplement to that of the Rhynchota. No particulars as to the economic importance of the species mentioned are given.

Spassky (S. A.). **Вредныя насѣкомыя, встрѣчавшіяся на селекціонномъ участкѣ Алексѣевскаго Донского Политехническаго Института въ 1914 году.** [Insect Pests found on the Experimental Field of the Don Polytechnic Institute in 1914], Reprint from **«Извѣстія Алекс. Донск. Политехн. Института.»** [*Annals of the Don Polytechnic Institute*], *Novotcherkassk*, 1914, iii, no. 2, part 2, pp. 148–154, 10 figs. [Received 29th November 1916.]

Wheat and barley grown on the experimental field were attacked in May by *Oria* (*Tapinostola*) *musculosa*, Hb., the caterpillars of which were found up to the second half of June, when they entered the earth and pupated, the adults appearing after the end of that month. Later on, in June, the crops suffered from *Anisoplia austriaca*, Hbst. Maize was injured by *Pentodon idiota*, Hbst., and *Euxoa* (*Agrotis*) *segetum*, Schiff. The adult beetles of *P. idiota* gnaw a deep hollow in the stem, just underneath the surface of the soil, while the caterpillars of *E. segetum* attack the stem somewhat higher up.

Spassky (S.). **О вредныхъ насѣкомыхъ Донской Области.** [Insect Pests of the Province of Don], Reprint from **«Извѣстія Алексѣевскаго Донского Политехническаго Института.»** [*Annals of the Don Polytechnic Institute*], *Novotcherkassk*, 1916, v, no. 1, part 2, pp. 219–226.

This list of insect pests from the Province of Don, includes :—

Orthoptera : *Oedaleus* (*Pachytylus*) *nigrofasciatus*, De G. ; *Calliptamus* (*Caloptenus*) *italicus*, L., amongst which an outbreak of a disease caused by the fungus, *Empusa grylli*, took place in August ; and *Gryllotalpa gryllotalpa*, L. (*vulgaris*, Latr.).

Thysanoptera : *Haplothrips tritici*, Kurdj., in the larval stage on wheat.

Rhynchota : *Aelia acuminata*, L., some of which were infested with eggs of a parasite, probably a species of *Phasia* ; *Eurygaster integriceps*,

Osh.; *Stephanitis* (*Tingis*) *pyri*, F.; *Aleurodes* sp., found in great numbers in September on leaves of garden convolvulus.

Lepidoptera: *Hyponomeuta malinellus*, Zell.; *H. variabilis*, Zell.; *Cydia pomonella*, L.; *Zeuzera pyrina*, L.; *Phlyctaenodes* (*Botys*) *sticticalis*, L.; *Pyrausta nubilalis*, Hb. (*Botys silacealis*, Hb.); *Homoeosoma nebulella*, Hb.; *Pieris brassicae*, L.; *Phalera bucephala*, L., on oaks, willows and nuts; *Trachea* (*Hadena*) *basilinea*, F.; *Oria* (*Tapinostola*) *musculosa*, Hb., which is becoming a very serious pest; and *Euxoa* (*Agrotis*) *segetum*, Schiff.

Coleoptera: *Ophonus* (*Pardileus*) *calceatus*, Duft.; *Agrilus* sp. attacking raspberries; *Agriotes lineatus*, L. (*segetis*, Bjerk.), on potatoes; *Mordellistena parvula*, Gyll., and the Longicorn, *Agapanthia dahlii*, Richt., attacking the stems of sunflower; *Crioceris duodecimpunctata*, L., on asparagus; *Melasoma* (*Lina*) *populi*, L., and *M.* (*L.*) *saliceti*, Weise, on poplars (*Populus canadensis*) and on willows; *Galerucella luteola*, Müll., on elms; *Bruchus pisorum* (*Laria pisi*) on peas; *B.* (*L.*) *lentis*, Boh., on lentils; *Balaninus* sp., infesting acorns; *Anthonomus pomorum*, L.; *Apion pomonae*, L.; *Byctiscus betulae*, L. (*Rhynchites betuleti*, F.); *R. bacchus*, L.; *Scolytus* (*Eccoptogaster*) *scolytus*, F., which was found together with *S.* (*E.*) *multistriatus*, Marsh., and *S.* (*E.*) *pygmaeus*, F., in dying elms; *Hylesinus fraxini*, F., on ash trees; *Rhizotrogus aequinoctialis*, Hbst.; *Anisoplia austriaca*, Hbst., and *Pentodon idiota*, Hbst. (*monodon*, F.).

Diptera: *Mayetiola* (*Cecidomyia*) *destructor*, Say, the cocoons of which were heavily infested with the Chalcid, *Merisus destructor*, Say, and the Proctotrupid, *Polygnotus minutus*, Lind.; *Rhagoletis* (*Spilographa*) *cerasi*, L., the larvae of which injured cherries, the pupae being found in the soil after the end of July; and *Phytomyza* sp., the larvae of which mined the leaves of peas.

Hymenoptera: *Hylotoma rosarum*, F., and *Eriocampoides limacina*, L. (*Eriocampa adumbrata*, Klug) were both found in the larval stage on leaves of cherry in September; and *Cephus pygmaeus*, L.

Lentz (I.). **Ловчіе посѣвы для майскихъ жуковъ.** [Trap Crops against Cockchafers.]—**«Земледѣлецъ.»** [*The Agriculturist*], *Petrograd*, xxi, no. 3, March 1916, pp. 115–116. [Received 13th November 1916.]

During the last severe outbreak of larvae of *Melolontha*, the author observed that the greatest damage was done on those fields which were under clover when the adults last appeared in large numbers. This recurs once in every four years, and the maximum amount of injury is noticed two years afterwards, when the larvae have become mature. As the females prefer friable soil for oviposition, the author suggests that in the year when the adults appear, or the year previously, wide strips of oats and red clover should be sown around forests. These should be separated from the remaining fields by a trench 2 feet deep, with vertical walls. During the third summer, these strips must be ploughed up and the larvae picked out of them. In orchards, trap-plants may be used, such as strawberries, salad and beet, the roots of all of which are very attractive to the larvae.

Ol (I. A.). **Мѣры борьбы съ вредителями капусты.** [The Control of Pests of Cabbage.]—**«Прогрессивное Садоводство и Огородничество.»** [*Progressive Fruit-Growing and Market-Gardening*], *Petrograd*, xiii, no. 40, 15th October 1916, p. 924.

Two of the chief cabbage pests are *Chortophila brassicae*, Bch., and *Baris chloris*, F. A general account of the life-history of, and measures against both these pests is given. *B. chloris* oviposits on the stalks of cabbage, on which the larvae live and pupate; pupation also takes place in the earth, in which the adult beetles pass the winter. Affected plants should be destroyed and, in transplanting, young cabbages should be grown as far as possible from infested areas.

Kulagin (Prof. N.). **Къ вопросу о работахъ энтомологическихъ станцій.** [On the Question of the Work of Entomological Stations.]—**«Земледѣльческая Газета.»** [*Agricultural Gazette*], *Petrograd*, no. 41 (157), 21st October 1916, pp. 1079–1081.

The author urges the importance of the establishment, by the Zemstvos and the Department of Agriculture, of Entomological Stations or Entomological branches of the existing Experimental Stations. These stations should report annually, on the dates of appearance of various insect pests and the amount of damage done; on the influence of local meteorological conditions and methods of cultivation on insect life; on the part played by parasites; on experiments on the bionomics of pests and their control conducted at the Station during the year; and on any special problems studied.

Shtcherbakov (Th.). **Вредны-ли для сѣменного краснаго клевера жуки-апіоны?** [Are species of *Apion* injurious to the Seed of Red Clover?]—**«Хозяйство.»** [*Husbandry*], *Kiev*, xi, no. 39–40, 20th October 1916, pp. 644–654.

This is a continuation of the discussion on the economic importance of weevils of the genus *Apion*, and the author here replies to the criticism of his views by A. Sopotzko [see this *Review*, Series A, iv, p. 167]. He maintains his previous opinion, that these weevils have no effect of economic importance on the crop of seed in clover. He also denies the statement as to the injury caused by the burrow gnawed by the larvae in the base of the inflorescence for the purpose of pupation, which he insists is practically harmless.

Dobrovliansky (V.). **Вредно-ли или нѣтъ скармливаніе животнымъ "жучкового" гороха.** [Whether the Feeding of Animals with Peas infested with *Bruchus pisorum*, L., is injurious.]—**«Хозяйство.»** [*Husbandry*], *Kiev*, xi, no. 39–40, 20th October 1916, pp. 654–655.

Bruchus pisorum (*pisi*), besides damaging peas, is also certainly injurious both to man and some animals, when present in peas used for food. This is probably due to the presence of cantharidine in the excreta and the bodies of the insects, though some insectivorous animals including poultry are not affected by this poison. Infested peas should therefore be cleaned by special machinery before being used for food.

VOGLINO (P.). *Prospaltella berlesei* **against** *Diaspis pentagona* **in Piedmont in 1915.**—*Internat. Rev. Science & Practice Agric., Mthly. Bull. Agric. Intell. & Pl. Dis., Rome,* vii, no. 6, June 1916, pp. 905–906. [Abstract from *Relazione del Direttore, Osservatorio Autonomo di Fitopatologia, Torino,* 1916, 16 pp.] [Received 10th November 1916.]

This report deals with the control of *Aulacaspis* (*Diaspis*) *pentagona* in Piedmont in 1915 [see this *Review*, Ser. A, iii, p. 251]. In the spring 304,700 mulberry twigs covered with *Prospaltella berlesei* were distributed. As a result mulberries have thriven almost everywhere, and *P. berlesei* limits the scale-infestation in a great many places. In very wet localities, where the conditions were highly favourable to the scale, the beneficial effect of *P. berlesei* was most noticeable. *A. pentagona* multiplied with facility on certain pruned mulberries, and on these the action of *P. berlesei* was generally less effective. The spread of the Chalcid is not sufficient to stop scale-infestation in a short time and in some regions it is necessary to further its dissemination by artificial means. Numerous and extensive breeding centres of *P. berlesei* now exist in Piedmont for the purpose of supplying parasitised material. In order to enable the parasite to exercise its beneficial influence on the mulberries, it is essential that normal pruning should be carried out every two to four years. Where the parasite has been distributed, the branches must never be cut before the month of March and cut branches should always be left bound together in bundles in the fields or on the trees. In the case of peaches and various ornamental trees attacked by the scale, a thorough distribution of *P. berlesei* should not absolve growers from carrying out a careful winter cleaning of the trunks and branches. In all parts of Piedmont the Coccinellid, *Chilocorus bipustulatus*, was also found to be an active destroyer of this scale.

VOGLINO (P.). **The Life-History and Control of the Vine Moths,** *Conchylis ambiguella* **and** *Polychrosis botrana*: **Observations made in 1914 by the Plant Diseases Observatory of Turin, Italy.**—*Internat. Rev. Science & Practice Agric., Mthly. Bull. Agric. Intell. & Pl. Dis., Rome,* vii, no. 6, June 1916, pp. 906–908. [Abstract from *Boll. Minist. Agricoltura, Industria e Commercio, Rome,* Year xiv, Ser. B, ii, no. 1–2, pp. 21–38.] [Received 10th November 1916.]

In 1914 the observations on the life-history of *Clysia ambiguella* and *Polychrosis botrana* begun in the previous year [see this *Review*, Ser. A, ii, p. 666] were continued in Piedmont, the life-history of *C. ambiguella* becoming the chief object of attention, though further information was obtained regarding *P. botrana*, which is the more injurious species in that region. In the different vine-growing localities cages were erected, measuring 7 ft. 10 in. by 3 ft. 11 in. and 7 ft. 9 in. in height and made of wire gauze with meshes of 2 mm. sustained by massive wooden frames. Each cage enclosed one or two vines, and was provided with a maximum and minimum thermometer, a barometer and a hygrometer. Smaller cages covered with wire gauze were also used. The material obtained by this means was forwarded periodically to Turin. The investigations are described in detail, the following being some of the conclusions drawn:—The life-cycle of *C. ambiguella* and *P. botrana*

did not differ very much from that of 1913 in reference to changes of temperature and moisture, except that the hatching period of the summer moths was prolonged. The use of large cages was not always successful; disease, chiefly due to *Botrytis*, greatly reduced the numbers of the larvae and the growth of the vines was generally late and irregular. The small cages suspended to the vine props in the rows were found much more practical, and afford the only means by which the vine-grower can keep a watch for the appearance of the moths and the moment of their maximum flight in his vineyard, in order to apply treatment. In addition to a few Arachnids and some fungi (chiefly *Botrytis*), the larvae and adults of *Coccinella 7-punctata* were effective in destroying the vine-moth larvae. A 2 per cent. nicotine solution gave good results in some localities, though it produced scorching in almost all cases. The first treatment must be applied, if possible, before the flowers open, to avoid injury to them. Tobacco extract (2 per cent.) gave good results against the second generation, preventing the passage of the larvae from one grape to another. The most effective remedy against the larvae of the first generation is lead arsenate mixed with Bordeaux mixture in the proportion of 1 per cent., but owing to its poisonous properties (which absolutely preclude its employment against the second generation), its use is advised with hesitation, more particularly as a 2 per cent. solution of tobacco extract, mixed with sodium carbonate or Bordeaux mixture, gives good results when sprayed at the proper time with powerful jet pumps. Two years experience proves that to obtain good results with 2 per cent. tobacco extract, two sprayings are required against both the first and second generation, one shortly after the adults begin to emerge and the second during the period of maximum flight. A mistake in regard to the date, or faulty apparatus, is responsible for failure. Though tobacco extract is recommended, it is pointed out that it is at present very costly and its nicotine content is variable and may result in scorching. Cleaning the branches in winter, removing the tips of the canes (used as vine-props), and destroying the stubble between the rows, greatly reduced infestation. Rags attached at the points of bifurcation of the branches were effective in collecting the pupae, and the substitution of stone and ferro-concrete supports, connected by galvanised iron wire, for wooden props, always gave excellent results.

Topi (M.). **Tobacco Juice for the Treatment of the Vine-Moths,** *Polychrosis botrana* **and** *Conchylis ambiguella,* **in Piedmont.**—*Internat. Rev. Science & Practice Agric., Mthly. Bull. Agric. Intell. & Pl. Dis., Rome,* vii, no. 6, June 1916, pp. 908–910. [Abstract from *Rendiconti Sedute R. Accad. Lincei, Classe Scienze Fisiche, Matematiche e Naturali, Rome,* Ser. 5, 5th March 1916, pp. 349–353.] [Received 10th November 1916.]

In some tests with a 2 per cent. tobacco juice solution, the first application was made on the 21st July and the second on the 28th July, 1915. At the time of the first application the eggs of both *Clysia ambiguella* and *Polychrosis botrana* were abundant on the grapes. Unhatched eggs were still very numerous at the time of the second treatment. On the 25th August counts were made of the injured

grapes from the bunches of four vines, two treated and two untreated, belonging to the two varieties "dolcetto" and "barbera." The number of grapes injured or destroyed on the treated "barbera" vine were 260, on the untreated one, 560, and the corresponding figures for the "dolcetto" were 403 and 526. The larvae of *C. ambiguella* were found in far greater numbers on the "dolcetto" than on the "barbera" variety, though the stocks of both stood in the same rows. It is not known whether this was due to a preference by *C. ambiguella* for this variety, or whether it was caused by the earliness of the "dolcetto," or the well known earlier development of *C. ambiguella* as compared with *P. botrana*. It follows that the effect of the treatment differed, and the applications proved to have been made in good time for the "barbera," but were too late for the "dolcetto." This is an additional reason for growing a single variety on each plot of land in new plantations, control being thus much simplified. If *C. ambiguella* is more numerous than *P. botrana*, it is advisable to apply treatment some days earlier. Many of the grapes of "barbera" treated with tobacco extract were only slightly attacked, whereas the percentage completely spoilt or seriously attacked was much higher on the untreated vine. On the treated vine only one larva was found to every 8 or 10 grapes attacked, while the proportion on the untreated stock was one to every three or four. The results therefore were to reduce by about 50 per cent. the number of grapes completely or partly spoilt. These results, obtained with two summer treatments only, are considered to indicate a promising method of control.

ESCHERICH (K.). **Method of Cockchafer Control used in Germany.** —*Internat. Rev. Science & Practice Agric., Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, vii, no. 6 June 1916, pp. 910–912. [Abstract from *Zeitschr. f. angewandte Entomologie, Berlin*, iii, no. 1, March 1916, pp. 134–156.] [Received 10th November 1916.]

Extensive experiments for the control of *Melolontha melolontha* and *M. hippocastani* carried out in the Bienwald in the Upper Palatinate are described. This State forest covers several thousand acres and has for many years been heavily infested with cockchafers, widespread damage being sometimes done. It is composed of *Pinus*, larch and Weymouth pine, as well as beech and oak. The comparatively dry, sandy and stony soil, forming dunes, favours the insects, the development of which has also been fostered by the very mild winter climate and until a few years ago by bad methods of forestry. The control of cockchafers was begun in 1882, but without satisfactory results. Seventeen years of experience from 1882–1899 showed that the control exercised by birds and mammals is wholly insignificant, while conditions are unfavourable to the fungus, *Botrytis tenella*. Collecting and trapping the larvae or destroying them in the soil with benzine or carbon bisulphide all proved inadequate methods of control. The present forester proposed in 1899 to destroy these pests by a method based on the fact that at the time of flight and mating they exhibit a marked preference for certain trees growing in the open fields and allowing of easy flight in and around their tops. These trees, in order of importance, are :—Beech, larch, hornbeam, birch and oak. In the

course of felling, isolated trees or groups of trees well exposed to the sun and with plentiful foliage are left standing. The selected trees are of small size, but with a well-developed top. In forests composed exclusively of deciduous trees, the formation of such groups is difficult and partial success is all that can be hoped for. The Bienwald is divided into sections of 741–988 acres, in each of which the work is done by one or more gangs of seven persons. The captured cockchafers are killed with carbon bisulphide (0·16 oz. of CS_2 per gallon of cockchafers) and afterwards used for manure. The number of gangs per section varies according to the quantity of cockchafers. In 1903, 15 gangs were used to clear 741 acres; in 1907, 30 for 4,128 acres; in 1911, 52 for 4,330 acres; and in 1915, 42 for 4,330 acres. The success of the work depends on the ability of the man in charge, who must determine the time when operations are to be begun. At the time of flight he must go over his section every evening to ascertain where the cockchafers have settled, in order to make the necessary arrangements for their capture the following morning; the insects must be gathered at least once a day. In 1907, 15 millions were captured; in 1911, 22 millions; and in 1915, 14 millions. The increase up to 1911 is due chiefly to the increased area and improved technique of control. Though this method did not entirely free the forest, the insects were so reduced in numbers that it became possible to carry on forestry on the right lines. The larvae cause great havoc in the nurseries, and it was calculated that two larvae per 11 square feet, in their third year of development, are sufficient to destroy all the young plants of a nursery. Collecting the cockchafers in the woods around the nurseries is not sufficiently effective, but when no rain falls during the flight period, excellent results are obtained by covering the soil with quicklime at the rate of 16 cwt. per acre. Rain permits the females to pass through the layer of lime in order to oviposit in the ground. Lime spread immediately after rain is also ineffective and the success of this method therefore depends on the weather. Trials are however being made with naphthaline, which is apparently uninfluenced by weather conditions. The control work in the Bienwald was relatively inexpensive, the cost being about 5*s.* 7*d.* per acre in 1907, 4*s.* 7*d.* in 1911, and 4*s.* in 1915, while the value of the forest has increased by nearly £4,000 a year as a result.

Lüstner (—). *Agrotis segetum*, **Beet and Potato Pest in Germany.**—*Internat. Rev. Science & Practice Agric., Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, vii, no. 6, June 1916, p. 914. [Abstract from *Amtsblatt der Landwirtschaftskammer für den Regierungsbezirk Wiesbaden u. Zeitschr. des Vereins nassauischer Land- u. Forstwirte, Wiesbaden*, 97th year, no. 37, pp. 277–279.] [Received 10th November 1916.]

During 1915, the larva of *Euxoa* (*Agrotis*) *segetum* caused widespread injury in the beet and potato fields in Germany. This infestation is believed by the author to be abnormal and possibly related to the long period of drought during the spring and summer of 1915, which destroyed the usual food of the larvae. In one locality the larvae disappeared completely from the potato fields after a fall of rain.

Wahl (R. O.). **Notes on some common Insect Pests of the Vegetable Garden.**—*Union of South Africa Dept. Agric., Pretoria*, no. 14, 1916, pp. 19–24.

A short account of the life-histories and control of the common insect pests in South African gardens is given. The following poison bait is advised for cutworms: 1 lb. of arsenite of soda dissolved in 10 gals. of water, and mixed with 8 lb. of treacle or brown sugar, is used to moisten lucerne or barley chaff which is then scattered broadcast on the land. If the seedlings are already planted, this bait is placed round each plant, taking care to avoid touching it. For the small cabbage moth, *Plutella maculipennis*, Curt. (*cruciferarum*, Z.) paraffin emulsion and red oil in the proportion of 1 : 32, or even weaker, is recommended. For cabbage Aphids resin or nicotine wash are most successful. All cruciferous plants should be removed as soon as the crop is harvested. The bug, *Bagrada hilaris*, which is one of the most formidable pests, attacks cereals as well as cruciferous plants and may be destroyed with a red oil emulsion. If only hard water is obtainable, 1 oz. of washing soda should be added to every 4 gals. The maize stalk borer (*Busseola* (*Sesamia*) *fusca*, Hmp.) may be controlled by destroying the plants immediately the cobs are removed, taking care that all pupae and caterpillars in the stems are killed. No plants should be allowed to remain through the winter. Both for this moth and for *Heliothis obsoleta*, F. (*armigera*, Hb.), ploughing during the winter months, so as to expose the pupae to frost, is recommended. Beetles of the genus *Mylabris* may be treated by spraying with arsenate of lead or Paris green, but a better method is to collect them by hand in the morning or evening and drop them into boiling water or paraffin. Against the potato tuber moth (*Phthorimaea* (*Gelechia*) *operculella*), preventive measures must be adopted. Sound tubers should be stored before the sun has set and the moths are on the wing, and the entire crop should be removed as soon as it is ready to dig. Frequent cultivation, removing infested tops, deep planting and compact ridging will help to prevent infestation. Infested tubers may be fumigated with carbon bisulphide in air-tight rooms using 8 lb. or 5 pints of bisulphide to 1,000 cubic feet of air space. Infested tubers should not be used for seed.

Caesar (L.) & Howitt (J. E.). **The more important Insects and Diseases attacking Peach Trees.**—*Ontario Dept. Agric., Fruit Branch Hortic. Expt. Sta., Toronto*, Bull. 241, July 1916, pp. 41–51, 7 figs. [Received 20th November 1916.]

This article contains a popular account of the following pests of peach trees:—San José scale (*Aspidiotus perniciosus*); peach tree borer (*Aegeria* (*Sanninoidea*) *exitiosa*); lesser peach-tree borer (*Aegeria* (*Sesia*) *pictipes*); plum-tree curculio (*Conotrachelus nenuphar*); and the fruit-tree bark-beetle or shot-hole borer (*Scolytus* (*Eccoptogaster*) *rugulosus*). The usual control measures are advised.

The second part of the article deals with various diseases of peach trees and their control measures. These include peach yellows, peach leaf curl (*Exoascus deformans*), brown rot (*Sclerotinia fructigena*), peach scab or black spot (*Cladosporium carpophilum*), powdery mildew (*Sphaerotheca pannosa*), crown gall (*Pseudomonas tumefasciens*), and canker or gummosis of peach trees.

A Pest of the Horse Bean.—*Agric. News, Barbados,* xv, no. 379, 4th November 1916, p. 363.

Caterpillars of *Anticarsia* (*Thermesia*) *digitalis* are reported in Grenada as attacking the foliage of horse-beans. Lead arsenate might be used, if worth while, but a preliminary experiment would be needed to find what strength was non-injurious to the plants.

Gardiner (R. E.). **An Appliance for Destroying the French Bean Fly.**—*Queensland Agric. Jl., Brisbane,* vi, no. 4, October 1916, pp. 228–231, 3 figs.

The action of this apparatus depends upon a habit which this fly [*Agromyza phaseoli*] has of making a rapid upward flight when disturbed. In its simplest form it consists of a sheet of window glass set in a light wooden frame, with a curtain of calico about 6 in. wide attached to three of its sides and a pair of wooden handles on the upper side. The under side of the glass is lightly sprinkled with kerosene, which spreads into a thin film over the glass. The frame is then carried over the young bean plants with the open side in front, and about 9 or 10 in. from the ground, the rear part of the glass just clearing the young plants. The advancing sheet of glass passes over the flies before they rise, and as they do so directly upwards, they strike the glass, become saturated with kerosene and die instantly. A larger horse-drawn apparatus, constructed on a similar plan, is suitable for larger areas. After about nine days the flies are less destructive, and as they prefer young beans, a good trap may be prepared by sowing a row of beans in the near vicinity 9 or 10 days after the crop is planted.

Red Oil for the Red Spider.—*Queensland Agric. Jl., Brisbane,* vi, no. 4, October 1916, p. 255.

The best remedy for fruit attacked by this pest is an application of red oil emulsion, either in winter or early spring. Late spraying has proved both feasible and successful. Oils applied when the fruit buds are swelling stimulate the tree and are very effective against the mites. If they are present on the leaves during the summer, a lighter-bodied oil may be used, which must be plentifully mixed with soap to render its application safe.

South (F. W.). **Summary of Locust-Work for the 2nd Quarter, 1916.**—*Agric. Bull. Fed. Malay States, Kuala-Lumpur,* iv, no. 12, September 1916, pp. 385–390. [Received 24th November 1916.]

The annual campaign against locusts began in March and was carried on throughout April and the whole or part of May in the district of Tampin and in Malacca and Johore. Tables are given showing the number of swarms in the various States, the localities in which they occurred and the number of swarms poisoned. A considerable number of flying swarms escaped, largely owing to the shortage of labour in certain centres. The weather during the quarter under review appears to have been very favourable to locusts, and in spite of the destruction of large numbers of hoppers, the winged swarms in the Tampin district,

Malacca and Johore are now as numerous as they have ever been. Most of them have, however, been located and preparations have been made for a vigorous campaign in July and the following months, the success of which will depend on the supply of labour.

SANDERS (G. E.). **The Brown-tailed Moth.**—*Canadian Hortic. & Bee-keeper, Toronto*, xxiv, no. 11, November 1916, p. 282.

Euproctis chrysorrhoea, which was so prevalent in 1913–14 in Nova Scotia [see this *Review*, Ser. A, iii, p. 678], now appears to be under control, and during the winter of 1915, only 14,755 nests were found in the province.

GIRAULT (A. A.). **Descriptiones Hymenopterorum Chalcidoidicorum variorum cum Observationibus. II.**—*Entom. News, Philadelphia*, xxvii, no. 9, November 1916, pp. 401–405.

The Chalcidoidea described in this paper, include:—*Signiphora dipterophaga*, sp. n., in a tunnel of *Diatraea* in sugar-cane from Trinidad; *Coccophagus aleurodici*, sp. n., from *Aleurodicus* on *Theobroma bicolor* in Trinidad; *Neocatolaccus syrphidis*, sp. n., reared from a Syrphid pupa in Trinidad; and *Eulophus magnisulcatus*, sp. n., reared from *Coleophora* sp., on cherry in New Jersey.

WHITE (W. H.). **The Sugar-beet Thrips.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. 421, 26th October 1916, 12 pp., 8 figs. 2 plates.

Heliothrips femoralis, Reut., is widely distributed and is found principally in greenhouses, in which it has been recorded in the British Isles, Italy, Belgium, Austria, Finland, German East Africa, Sweden, and Spain, and it is also common in the United States. It was first recorded on sugar-beet out of doors at Washington, D.C., in 1904, then on sugar-beets in California in 1907, and in 1914 from Porto Rico on sugar-cane [see this *Review*, Ser. A, ii, p. 308]. It has also been found on a great variety of other plants. A full description of all the stages of this pest is given. Spraying is recommended as the best method of control. In greenhouses a strong spray of water is sufficient, as it drives the younger stages from the leaves to which they are unable to return and therefore die. In the course of some experiments a solution of 4 oz. nicotine sulphate with 4 lb. fish-oil soap in 50 U.S. gals. of water killed 60 per cent. of the adults and 40 per cent. of the nymphs. With 5 oz. nicotine sulphate in the same mixture, 90 per cent. of the adults and 60 per cent. of the nymphs were killed, and with 6 oz. nicotine sulphate, all the adults and 95 per cent. of the nymphs were destroyed. The globule of excretion round the nymph may render it less susceptible to the spray. The sprays should be applied to both sides of the leaves on a dull or cloudy day when the adults are less active. A bibliography of 18 books concludes the article.

WILLIAMS (L. T.). **Notes on the Egg-Parasites of the Apple Tree Tent-Caterpillar** (*Malacosoma americanum*).—*Psyche, Boston, Mass*, xxiii, no. 5, October 1916, pp. 148–153.

During the spring and summer of 1915 an attempt was made, which was only partially successful, to study in detail the life-histories of

some of the egg-parasites of *Malacosoma americana*. Four separate lots of eggs were collected during the spring and were kept under different conditions, some being placed in a greenhouse, some in the open air and others in cold storage. Six species of parasites were bred from these eggs, the most abundant being the Eulophid, *Ablerus clisiocampae*, Ashm. This insect was described as a caterpillar parasite, but as the APHELININAE, the sub-family to which it belongs, are otherwise exclusively parasitic on COCCIDAE, and as it was afterwards reared by Howard and others from *Aspidiotus* and *Chionaspis*, it was supposed that Ashmead had been mistaken. In the present case, not only were the trees from which the eggs were taken practically, if not absolutely, free from scales of any kind, but the egg-masses were in all cases removed from the twigs on which they had been deposited and placed by themselves. In these circumstances the correctness of the original record appears to be completely corroborated. The exact relationships of this insect to such widely separated hosts would appear to be a problem of considerable biological interest.

Other parasites obtained included the Scelionid, *Telenomus clisiocampae*, which was not abundant, and the Encyrtid, *Ooencyrtus clisiocampae*, Ashm., which was next in abundance to *A. clisiocampae*. A species of *Tetrastichus* was comparatively numerous, but few details of its life-history could be ascertained, owing to its failure to oviposit normally. It passes the winter as a full-grown larva in the host egg and emerges a few days before the adult host. Two specimens of the Encyrtid, *Aphycoideus io*, Gir., were also bred from this moth.

A bibliography of five works is appended.

WEISS (H. B.). *Monarthropalpus buxi*, **Lab., in New Jersey (Dip.).**—*Psyche, Boston, Mass.*, xxiii, no. 5, October 1916, pp. 154–156. 1 plate.

This article does not appear to contain any new information except that this Cecidomyid is now known to occur in widely separated parts of the State of New Jersey.

PEAIRS (L. M.) & MERRILL (J. H.). **The San José Scale** (*Aspidiotus perniciosus*, **Comstock.**)—*Kansas State Agric. Coll. Experiment Station, Manhattan*, Bull. no. 214, September 1916, 28 pp., 10 figs. (Received 29th November 1916.]

A full account is given in this paper of the life-history, food-plants and natural enemies of this well-known pest. The control measures described include fumigation, dipping and spraying. Full particulars are given of the manufacture and uses of lime-sulphur. Spraying apparatus and power sprayers are described, including the traction, gas, compressed-air, and gasoline varieties, the last-named being considered the most efficient.

Propagación de la Prospaltela. [The Establishment of *Prospaltella*.]—*Gaceta Rural, Buenos Aires*, x, no. 3, October 1916, p. 150.

The satisfactory results obtained from previous experimental work [see this *Review*, Ser. A, iv, p. 515] have been maintained. From June to mid-September 1916, 4,650 fruit-growers applied for parasitised

twigs, and received in all over 530,000 twigs, making a total of 3,000,000 twigs distributed during three years. It seems probable that *Prospaltella berlesei* is now sufficiently established to check effectually the invasion of *Aulacaspis* (*Diaspis*) *pentagona*, and the distribution of parasitised twigs will probably be discontinued at the end of the current year.

CORTI (G.). **Pulgones del duraznero y del manzano.** [Peach and Apple Aphids.]—*Gaceta Rural, Buenos Aires*, x, no. 3, October 1916, p. 159.

For the destruction of *Aphis amygdali*, two sprays are recommended; the first, for application as a preventative against the hatching of the eggs, should be used in the winter and consists of 1 gal. kerosene, about $1\frac{3}{4}$ lb. thick milk of lime and 20 gals. of 3 per cent. Bordeaux mixture. The last-named ingredient is prepared from sulphate of copper, 6 lb.; milk of lime, or recently slaked lime, 6 lb.; water, 20 gals. The copper sulphate should be dissolved in hot water in a wooden vessel, the milk of lime, mixed in another vessel, should be added gradually, and lastly the water. The kerosene must be added while constantly stirring, until an emulsion is formed. For the second spray, used in the spring after hatching, from one to one and a half pints of tobacco juice, 1 lb. soft soap, and 20 gals. water, make an effective solution.

PÉE-LABY (L.). **Pour se débarrasser des Vers Blancs.** [How to destroy Cockchafer Larvae.]—*La Vie Agric. Rur., Paris*, vi, no. 47, 18th November 1916, pp. 379–380.

Several methods for the destruction of the larvae of *Melolontha* are recommended, including the injection into the soil of carbon bisulphide, about 3 cwt. to the acre, preferably in summer or autumn, and the use of calcium carbide, which is distributed along the furrow made by the plough and covered by the earth from the next. Fowls allowed to run on newly ploughed land will devour the grubs in large quantities. Land which cannot be treated by these methods, must be left fallow for a year or two and thoroughly cultivated before planting.

FEYTAUD (J.). **L'Essaimage du Termite Lucifuge.** [Swarming of the Termite, *Leucotermes lucifugus*, Rossi.]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xiv, nos. 9–10 & 11–12, September-October & November-December 1915, pp. 65–68 & 82–84. [Received 24th November 1916].

Swarming in this species of termite takes place only once in the year and occurs in Gascony during the latter half of May. From observations made during and after the swarming, the author is convinced that the termites are capable of pairing and oviposition immediately upon emergence from the nest during a swarm, and also that couples of imagines are capable of forming new nests without the assistance of workers, themselves becoming the kings and queens of the newly-formed colony. Thus two methods of propagation occur, by the formation of subsidiary colonies and by swarming.

La Fourmi-Manioc en Guyane (*Atta sexdens*, **L.**)—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xiv, no. 11–12, November-December 1915, pp. 90–91. [Received 24th November 1916.]

The information contained in this article has already been abstracted [see this *Review*, ii., p. 223].

Dépérissement des Orangers causé par un Nématode. [Damage to Orange-trees caused by a Nematode.]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xiv, no. 11–12, November-December 1915, p. 91. [Received 24th November 1916.]

Examination of the roots of orange-trees, which were dying in large numbers in Algeria, has revealed the presence of a Nematode, *Tylenchulus semipenetrans*, Cobb. Since Cobb's observations on this pest in California, it has been found in Spain, Syria and Australia. Treatments with carbon bisulphide and sulphocarbonates are being tested as control measures.

La Mouche des Fruits aux Environs de Paris. [Fruit-fly in the neighbourhood of Paris.]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xiv, no. 11–12, November-December, 1915, pp. 91–93. [Received 24th November 1916.]

In October 1914, *Ceratitis capitata*, Wied., was bred from late pears gathered at Asnières (Seine), the locality being the same as that in which Giard first recorded this insect in the neighbourhood of Paris in 1900, and again in 1906. It would be interesting to elucidate the method of hibernation of this tropical insect in the European climate. The duration of the pupal stage, which in Italy is from 10 to 11 days in summer and may be as long as 30 days in winter, leads to the conclusion that hibernation must take place in this stage. The apparently permanent presence of the fruit-fly in this region must be regarded as a new and serious danger to fruit culture ; it is hoped that the attempts to introduce some of its parasites into Italy and the Hawaiian islands may give satisfactory results.

FEYTAUD (J.). **Sur l'Invasion d'Otiorhynques de Saint-Pierre-d'Oléron.** [On the Invasion of *Otiorrhynchus* in Saint-Pirrre-d'Oléron.]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xv, no. 9–10, September-October 1916, pp. 102–105.

Otiorrhynchus sulcatus, F., had become very abundant on the island of Oléron when the author began his investigations in August 1913 [see this *Review*, Ser. A, ii, p. 229], and a considerable amount of damage was done in the vineyards. Oviposition having been completed in June and July and the next generation being therefore assured, the destruction of the adults would have been of little use. The young larvae had already begun to attack the roots, causing much more serious, although less obvious, damage than the adults. Prolonged submersion was impracticable and injections of bi-sulphide of carbon would have been costly and very little use in view of the sandy nature of the soil. The use of poultry was suggested for destroying larvae turned up by the plough, and immediately outside the affected zone a barrier of several sulphated rows was renewed every 8 days, in June and July.

The chief enemies of *O. sulcatus* are toads, hedgehogs and shrews, as well as Carabid and Staphylinid beetles. Of the vertebrates, the hedgehog appeared to be the most efficient.

To ensure the collection and destruction of the adults a syndicate was formed, and very good results were obtained in 1914, 206 lb., representing about 1,400,000 individuals being collected, almost all before oviposition. Collections are made during the early hours of the night, the weevils, which remain hidden all day at the foot of the vines, being then found on the shoots. Even since the war and the subsequent scarcity of labour, this work has been continued, and in 1916 the insects did but little damage in the zone which they invaded in 1914.

La Punaise bleue dans les Vignobles du Sud-Ouest. [Blue-bug in the Vineyards of the South-West.]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xv, no. 9–10, September-October 1916, pp. 110–111.

A warning is given against confusing the blue bug (*Zicrona coerulea*, L.), a very useful Hemipteron, with the flea-beetle (*Haltica ampelophaga*, Guér.), a vineyard pest on which it feeds and which it very closely resembles in appearance.

Report of the Deli Experiment Station for the Year ended 30th June 1916.—*Med. Deli Proefstation, Medan*, x, no. 3, September 1916, pp. 58–59. [Received 21st November 1916.]

Tobacco was greatly damaged by *Prodenia*, and on some low-lying lands was also attacked by *Helopeltis*. The larvae of *Acherontia* were found experimentally to eat tobacco. The use of Paris green and lead arsenate as insecticides is increasing. Great damage was done during the year under report by *Lasioderma serricorne*, although ample supplies of carbon bisulphide were obtainable. A beginning has been made of a "black list" of brands of tobacco, cigars and cigarettes infested by this beetle with the names of the firms selling them, and it is hoped that the publication of this list will result in a better control in Egypt and Europe. In one box of 50 cigars no less than 5,446 specimens were found dead from want of food, nothing being left but the thickest part of the midribs and the residue was a fine powder smelling strongly of ammonia. Had the box been opened two months earlier, it is probable that some hundreds of beetles would have been set free, while the manner and extent of their distribution would have been entirely dependent upon the method adopted by the purchaser in returning it to the vendor.

De Trekmade (Rups van den kleinen Wintervlinder, *Cheimatobia brumata*, L.) [The Processionary Caterpillar of the small Winter-Moth.]—*Med. Phytopath. Dienst, Wageningen*, no. 3, September 1916, 22 pp., 2 plates & 1 map. [Received 27th November 1916.]

The life-history of *Cheimatobia brumata*, L., is dealt with in detail in this paper. When this pest appears in large numbers in orchards, the damage done in Holland is very serious. The importance of control measures is considerable, and these may double or even treble the value of the crop. It is calculated that in the first year in which

adhesive banding came into something like general use the value of the Dutch fruit crops was increased by over £10,000, and a very large measure of success may be hoped for if control measures are systematically carried out. The following trees are attacked: Cherry, apple, pear, gooseberry, black currant, plum, hazel, white thorn, beech, hornbeam, willow, elm, oak, lime and wild rose; red currant is rarely or never attacked. The caterpillars especially prefer trees which have been sprayed with Bordeaux mixture and have a vigorous leafy growth, and it is thought not unlikely that the outbreaks of *C. brumata* in the Bangert district in 1909 and 1910 were aggravated by the use of this spray. Apple and black currants suffer most in the flowers, cherry and gooseberry in the fruit, though generally speaking the chief damage is to the foliage, flowers and fruit together, and the older, well-established trees seem to suffer more than the younger. This pest is found all over Holland, its distribution being shown on a chart. South Limburg and the area between the Meuse and the Rhine are seriously affected, other regions being much less so. This difference in distribution is possibly due to a preponderance of cherry trees in some districts, as this is a very favourite food-plant. Loss has been greatly diminished in many of the worst affected areas as the result of an active propaganda on behalf of tree banding. In South Limburg the bad effects of neglect and the good effects of control may be seen side by side. The spread of the pest from one area to another can hardly be due to the insect itself, owing to the inability of the females to fly, while the caterpillars can only travel relatively short distances or be blown from one tree to another by the wind. The nurseries are suspected of being a more important cause of distribution, and of 83 examined only about 10 were found to be free from this pest, though it is seldom numerous on young trees, owing to the constant pruning and continual cultivation of the soil between them. In orchards, where it is much less disturbed, it increases rapidly, but if the other trees, especially limes, in the neighbourhood of a proposed site are banded and otherwise looked after, it should be possible to keep such orchards free from this moth. In the case of larger areas, such as the Bangert, the spread of the pest from one orchard to another can only be kept in check by the general application of control methods. The first essential in planting a new orchard is to procure clean plants, and before these are taken up in the nursery, they should be carefully painted with a carbolineum solution; this indeed should be part of the winter practice in all nurseries. Regular pruning should be carried out in all orchards and the prunings carefully removed; bush fruits should be well pruned early. Poultry are very valuable in destroying all stages of this pest, and in hardly a single case where they were admitted to an orchard, was it found to be infested to any serious extent. The direct methods of control include the use of adhesive belts and spraying with 8 per cent. carbolineum solution or with some arsenical compound such as Paris green or lead arsenate. Adhesive bands on established trees are the cheapest, easiest and surest method of control. Carbolineum spray should be used in winter on all plants on which bands cannot be fixed, such as bush fruits. In orchards with grass underneath the trees and surrounded by a thorn hedge the trees should be banded and the hedge sprayed with carbolineum. An orchard of bush fruit only can be most cheaply treated with Paris green

as soon as attack is evident. Details are given as to the application of the three remedies suggested. No home-made adhesive is said to be really satisfactory. The bands should be 3–5 feet above the ground, and if the branches originate near the ground each should be banded separately. The bands should be at least $3\frac{1}{2}$ or 4 inches wide, and if the females are likely to be numerous, it is advisable to fix two bands on each trunk. The bark under the bands should be carefully searched for egg-masses and well dressed with 8–10 per cent. carbolineum. The bands should all be in place at the beginning of October, or even earlier, though observation is required to fix the most effective moment. Stress is laid on the necessity for banding several years in succession. Tar is much used in the Bangert instead of the commercial adhesive, because it is cheaper, but it suffers from the weather and requires constant watching and renewal. Spraying with carbolineum must be done thoroughly and every care taken to wet the under sides of the twigs and branches ; a fairly high pressure and a fine spray is advisable, and high pressure horse-sprayers have given excellent results. Bush fruit should be sprayed as a rule in January or at latest in the first half of February and fruit trees in February and March. The carbolineum should be first well mixed with a small quantity of water and the remainder subsequently added ; otherwise a uniform solution will not be obtained. The approximate quantities required are $3\frac{1}{2}$ pints for a medium-sized gooseberry bush, or less for a pruned currant bush, 21–25 pints for a young tree, and 9 gallons or more for a large tree. The cost may be reduced by the use of so-called insoluble carbolineum, which requires the addition of soap just before use. In spite of the risk of scorching, Paris green is a very valuable remedy, and only a very light spraying is necessary as it is very fatal to the caterpillars. As soon as any sign of attack is observed, the spray should be used (one-tenth per cent. by weight in water), care being taken to keep the mixture constantly stirred whilst spraying ; a good plan is to put a few large glass marbles at the bottom of the container and keep them in constant motion during the spraying ; this applies to small hand apparatus. Urania green is not so liable to settle. The addition of 1 per cent. of lime by weight greatly assists in preventing the settlement of the Paris green. High pressure and a fine spray is advised and a much smaller bulk of fluid is required than is the case with carbolineum. To prevent possible poisoning no fruit should be sprayed within at least four weeks before gathering. Lead arsenate is more costly than Paris green and the proportion required is higher, $\frac{1}{2}$ per cent. by weight of the paste, but it is recommended as causing less damage to the plants. It is stated that *Hibernia defoliaria*, L., is often found in company with *Cheimatobia brumata* from October to February, and *Anisopteryx aescularia*, Schiff., in March.

SUPINO (F.). *Triaenodes bicolor* **and** *Hydrocampa nymphaeata* **in the Rice Fields of the Province of Milan, Italy.**—*Internat. Rev. Science & Practice Agric., Mthly. Bull. Agric. Intell. & Pl. Dis., Rome,* vii, no. 7, July 1916, p. 1058. [Abstract from *Rendiconti R. Inst. Lombardo Scienze e Lettere, Milan,* Ser. II, xlix, nos. 2–3, 1916, pp. 108–114.] [Received 30th November 1916.]

Rice-growers near Milan have complained of injury to rice by aquatic larvae, and investigation has demonstrated the existence of

a harmless Dipteron, *Stratiomys chameleon*, L., and two injurious species, the Neuropteron, *Triaenodes bicolor*, and the Pyralid, *Nymphula* (*Hydrocampa*) *nymphaeata*, L. The larva of *T. bicolor* cuts the leaves of aquatic plants for use as a sheath or cover and also uses the rice leaves for that purpose. *N. nymphaeata* is more injurious, as it not only makes a sheath of the leaves, but also feeds on the rice-plants. As a control measure, the introduction of carp into the rice-fields is advised, as these fish destroy large numbers of the larvae.

Chavanne (J. J.). **Fungoid Diseases of the Sugar-cane at Tucuman (Argentina).**—*Internat. Rev. Science & Practice Agric., Mthly, Bull. Agric. Intell. & Pl. Dis., Rome*, vii, no. 7, July 1916, pp. 1039–1040. [Abstract from *Ministerio de Agricoltura de la Nación, Dirección General de Enseñanza e Investigaciones Agrícolas, Sección Escuelas Especiales, Buenos-Aires*, Year 1916, no. 51, pp. 5–32, 2 pl.] [Received 30th November 1916.]

The author considers that "polvillo" on sugar-cane is identical with "top-rot" occurring in Java, Mauritius, Demerara, etc. Although the pathological evidence as a whole points very strongly to a bacterial cause, the almost constant presence of larvae or other small organisms in the infected tissues suggests that these may play an important part in the spread of this disease. The larvae met with most frequently are Dipterous, almost all being those of the Ortalids, *Euxesta chavannei* and *E. argentina*, Bréthes. If these larvae, taken from diseased plants, are introduced into a deep wound produced artificially in the region of the terminal bud, the characteristic symptoms of "polvillo" will eventually occur.

De Gregorio (A.). **The Efficacy of** *Aphelinus silvestrii* **in Control of** *Chrysomphalus dictyospermi* **in Sicily**—*Internat. Rev. Science & Pract. Agric., Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, vii, no. 7, July 1916, p. 1056. [Abstract from *Nuovi Annali di Agricoltura siciliana, Palermo*, (6) v, part 1, January-March 1916, pp. 18–19.] [Received 30th November 1916.]

In the neighbourhood of Palermo, *Aphelinus silvestrii* has increased to such a degree that it has almost completely destroyed *Chrysomphalus dictyospermi*, and this scale no longer causes serious injury to citrus trees or fruits.

Topi (M.). **The Efficacy of Hot Water Treatment against "Cochylis" and "Eudemis".**—*Internat. Rev. Science & Practice Agric., Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, vii, no. 7, July 1916, pp. 1057–1058. [Abstract from *Rendiconti Sedute R. Accad. Lincei, Classe di Scienze fisiche, matematiche e naturali, Rome*, (5) xxv, 1st Half-Year, no. 7, 2nd April 1916, pp. 524–528.]. [Received 30th November 1916.]

The subject-matter of this paper has already been abstracted from another journal [see this *Review*, Ser. A, iv, p. 383], where the time of immersion at 150° F. is correctly given as 10 seconds, and not 10 minutes, as erroneously stated here.

JENARO (Mira). *Bombyx pini*, **a Spanish Pest of Pine.** —*Internat. Rev. Science & Practice Agric., Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, vii, no. 7, July 1916, pp. 1063–1064. [Abstract from *Revista de Montes, Madrid*, XLth year, no. 940, 15th March 1916, pp. 193–202.] [Received 30th November 1916.]

In the pine forests of the Dehesa de la Albufera extensive damage has been caused by *Cnethocampa* (*Liparis*) *processionea* and *Dendrolimus* (*Bombyx*) *pini*. Many trees were entirely defoliated and died rapidly, especially in hot and moist areas. A considerable number of trees were saved from destruction by active and well-organised measures. The most effective were :—Removal and destruction of the nests; hanging out white cloths at night covered with a sticky substance and strongly illuminated; spraying the smaller trees with a solution consisting of sodium arsenate, 10·5 to 12·2 oz., quick-lime, 2·2 lb., water, 22 gals.; and lastly by banding the trees and destroying the larvae which collect in front of the belts.

SAVASTANO (L.). **Le Fumagini negli Alberi coltivati ed il Tratamento con la Poltiglia Solfo-calcica.** [Sooty Fungus on cultivated Trees and Treatment with Lime-Sulphur.]—*Boll. R. Staz. Sperimen Agrum. Fruttic., Acireale*, no. 25, August 1916, 10 pp.

Though it has been maintained that Coccids, especially *Saissetia* (*Lecanium*) *oleae*, Bern. (olive scale), cause the sweetish exudation on which the sooty fungus develops, observation in the field shows that this is a morbid process independent of any parasite and therefore exclusively biological. It is believed that the fungi and Coccids are commensals, both living on the exudation of the host-plant, and that they cause an increased production of this by their presence.

SAVASTANO (L.). **La Poltiglia Solfo-calcica invernale.** [Lime-Sulphur Mixture for Winter Use.]—*Boll. R. Staz. Speriment. Agrum. Fruttic., Acireale*, no. 23, October 1916, 4 pp.

This bulletin deals with the use of the more concentrated solutions, intended for winter application, of the lime-sulphur mixture made to the formula of the station for citrus culture at Acireale [see this *Review*, Ser. A, ii, p. 412]. It is pointed out that on account of their greater concentration the same minute care in dilution is not necessary as in the case of the weak summer solutions. If too weak, the latter are inactive, while an excess of strength may seriously scorch the tender vegetation. This latter danger is naturally absent in winter.

SAVASTANO (L.). **La Pompa n. 6 per la Poltiglia Solfo-calcica e la n. 7 per il Petrolio Benzinato contro le Cavalette.** [The No. 6 Pump for Lime-Sulphur Mixture and the No. 7 Pump for Benzine-Petroleum used against Locusts.] — *Boll. R. Staz. Speriment. Agrum. Fruttic., Acireale*, no. 24, October 1916, 3 pp., 2 figs.

This bulletin describes the construction of two pumps specially adapted for lime-sulphur and for the benzine-petroleum mixture used against locusts.

LEGISLATION.

Ordinance relating to Insect Pests and Diseases in Western Samoa:— British Military Occupation of Samoa, Proclamation no. 25, 1916. [Received 10th November 1916.]

Under date of the 2nd February 1916, the Acting Administrator of Samoa has promulgated an order providing that all imported soil, plants, fruit, native matting, or other articles liable in the opinion of the Commissioner of Agriculture at Apia to be affected with insect pests or other disease, shall be subjected to such treatment as may be deemed necessary. Importation must be through the port of Apia. Before the above articles are exported, a certificate of the Commissioner to the effect that they are free from pests must be obtained. Where treatment is necessary, either for imports or exports, a fee of 3*d.* is charged for each box or parcel and for each plant dealt with. Any breach of the provisions of this ordinance is punishable by a fine not exceeding £5 or by imprisonment for not more than 30 days.

Regulations under the Ceylon Insect Pest and Quarantine Ordinance, no. 5 of 1901.—*Ceylon Govt. Gaz., Colombo*, no. 6,831, 27th October 1916.

Under the above Ordinance regulations are issued, dated 25th October 1916, which cancel previous ones dated 4th October 1910. The importation of tea seed from India is prohibited, except at the port of Colombo. Such imported seed must be disinfected at Colombo, unless accompanied by a certificate from a scientific officer either of the Indian Tea Association or of the Imperial Department of Agriculture to the effect that the leaf disease called Blister Blight (*Exobasidium vexans*) does not exist within a radius of 10 miles of the estate or garden on which the seed was grown. The process of disinfection will be carried out at the risk of the consignee.

Restrictions on Plant Importations into St. Lucia.—*Agric. News, Barbados*, xv, no. 378, 21st October 1916, p. 341.

All plants and seeds imported into St. Lucia are submitted by the Custom authorities to the Agricultural Superintendent, who inspects them, and disinfects them in such a manner as he deems adequate. Plants considered to be infected with any pest or disease that may be a source of grave danger to the Colony, may be destroyed. Under suspicious circumstances he may require the plant to be planted in some safe place, where he may inspect it from time to time and take such steps as he thinks fit to control any pest or disease present. The importation of any plant connected with any dangerous disease may be prohibited; this has been done in the case of coconuts from Trinidad, Tobago, Jamaica, Cuba or any part of Central or South America; banana plants from Trinidad, Tobago, or any part of Central and South America; cacao plants from South America. No citrus plant may be imported from the United States of America, Cuba, Porto Rico, Jamaica, Hayti or San Domingo. No rooted plant, or plants in earth may be imported from any of these countries, unless accompanied by a certificate to the effect that citrus canker does not exist and has not existed for the past two years in the place of exportation.

Instruction et arrêté du 15 septembre 1916 rélatifs à la vente et à l'emploi en Agriculture des composés arsenicaux. [Instructions and order of the 15th September 1916 relating to the sale and use in agriculture of arsenical compounds.]—*Jl. Soc. Nat. d' Hortic. de France, Paris,* xvii, October 1916, pp. 146–149.

The French Minister of Agriculture has issued an order, dated 15th September 1916, regulating the sale and the use in agriculture of insoluble arsenical compounds, the use of soluble forms of arsenic being prohibited. The complete text is given in this article and also that of the official instructions interpreting it. Insoluble arsenical compounds may only be sold and used if mixed with a coloured and odorous substance; the order prescribes the addition of 20 per thousand of pyridin, crude phenol, or nitrobenzene, and 2 per thousand of "vert sulfoconjugué," the mixture being made perfectly homogeneous. A license is required by traders, and both traders and users must keep arsenicals locked up, away from food intended for human or animal consumption. Arsenicals may only be sold in metal containers bearing prescribed labels, including one with the name of the vendor. A retailer must paste his name over that of the supplier, who is not deemed to be the vendor where a retail customer is concerned. All sales must be entered in a special book, which must not be destroyed for 10 years after use. A written order, or receipt of delivery, is required, and this must be kept for three years. No arsenical compounds may be used for market-garden or forage crops. They must not be used for poisoning seeds, or for destroying weeds in garden paths, etc. In vineyards, arsenical compounds are permitted, but must not be used after flowering. The only fruit-trees to which they may be applied are the apple, pear and plum, but treatment must be interrupted at blossoming time and definitely discontinued 15 days after resumption. Beets may be treated until one month after planting out. Osier-beds and nurseries of trees not bearing edible fruits may be treated with arsenical compounds at any time.

F. P. **L'interdiction de l'emploi des "composés arsenicaux solubles" en viticulture.** [The prohibition of the use of soluble arsenic compounds in vine-growing.]—*Rev. Viticulture, Paris,* xlv, no. 1164, 19th October 1916, pp. 247–248.

It is stated that vine-growers in France and Algeria are protesting against the above order forbidding the use of soluble arsenical compounds, it being pointed out that sodium arsenates and potassium arsenites have been in use for many years without bad results and that they provide the chief defence against *Haltica ampelophaga, Sparganothis pilleriana, Feltia* (*Agrotis*) *exclamationis,* etc.

L'emploi des arsenicaux solubles. [The use of soluble arsenicals.]—*Rev. Viticulture, Paris,* xlv no. 1167, 9th November 1916, p. 304.

It is stated that the use of soluble arsenicals, though prohibited by recent legislation [see above], will be permitted during the current season. Manufacturers who have purchased raw material, and vine-growers who have already bought these arsenicals, will therefore be unaffected.

Bahama Islands: The Plants Protection Act 1916.

The Plants Protection Act of 1914 is repealed and replaced by a new Act assented to on 1st August 1916. No importation of plants is permitted, except under the Rules made under the Act. By proclamation, plant importation may be prohibited, and districts within the Colony may be declared infected with plant disease, or to be clean; authorised officers are empowered to enter any building and open any receptacle suspected of containing plants illegally imported, which are instantly seizable. Except in cases of poverty, the owner must pay all expenses incidental to the treatment, removal or destruction of plants attackedby diseases or insect pests. Owners of suspected plants must give information to the proper authorities. Offences against the Act are punishable on summary conviction by a penalty of £20.

Bahama Islands: Rules made under the Plants Protection Act 1916.— *Official Gaz. Bahamas, Nassau,* no. 41, 7th October 1916, pp. 216–217.

Under these rules the following provisions are made:—Nassau is the only port of entry for plants in the Bahamas. All packages containing plants have to be delivered by the importer to the Comptroller of Customs. Unless an official certificate can be produced that they have come from a place free from disease, the plants will be inspected and, if necessary, fumigated or destroyed. All expenses of removal and disinfection must be defrayed by the importer, who must, if required, keep the Board of Agriculture informed as to the subsequent disposal of any plants subjected to treatment. Packages sent through the post are also liable to inspection. Plants imported in contravention of these rules may be seized and destroyed. When an area in the Colony is declared infected, every owner or occupier within it must notify in writing the existence of any disease on his plants, and the Board of Agriculture will prescribe the treatment to be applied. If the occupier fails to carry out the treatment, the officers of the Board may treat or destroy the plants at his expense.

ENTOMOLOGICAL NOTICES.

Mr. C. F. C. Beeson (Temporary Captain, R.A.M.C.), Forest Zoologist to the Government of India, has been on special duty in Mesopotamia since May 1916, in charge of anti-fly and vermin measures.

NOTICES.

Secretaries of Societies and Editors of Journals willing to exchange their publications with those of the Bureau, are requested to communicate with the Assistant Director.

The Subscription to the Review is 12s. per annum, post free; or the two series may be taken separately, Series A (Agricultural) being 8s., and Series B (Medical and Veterinary), 5s. per annum.

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WATSON (J. R.). **The Woolly Whitefly** (*Aleurothrixus howardi*) **in Florida Citrus Plantations.**—*Internat Rev. Science & Practice Agric., Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, vii, no. 7, July 1916, pp. 1062–1063. [Abstract from *Univ. Florida, Agric. Expt. Sta., Tallahassee*, Bull. no. 126, 1915, pp. 81–102.] [Received 30th November 1916.]

In 1909, *Aleurodes* (*Aleurothrixus*) *howardi*, Quaint. (woolly whitefly) was discovered for the first time in Florida near Tampa, having been probably imported from Cuba. By 1914 it had spread over five counties and will soon be common in all the citrus plantations of Florida. Injury is caused by the sucking of the juices until the plant withers, by the secretion of a honeydew on the leaves and fruits which forms a good medium for the growth of *Meliola camelliae* and other fungi, and by the attraction which the whitefly colonies have for *Lepidosaphes beckii* (purple scale). Both *Aschersonia aleurodis* (red fungus) and *Aegerita webberi* (brown fungus) grow badly on *A. howardi* and cannot prevent its spread. On some dead larvae a species of *Cladosporium* was found which is believed by the author to have been the cause of death. A Chalcid, *Eretmocerus haldemani*, is the most effective natural enemy. Good results in artificial control are obtained by applying oily mixtures in the early days of March, the first half of June, about mid-August, and early in November, when the insects are in the early stages and more sensitive to insecticidal action. The formula advised consists of 8 lb. whale-oil soap and 2 U.S. gals. of fine paraffin oil, the mixture being vigorously stirred so that it is well emulsified. One gallon of water is then added, stirring as above. This emulsion must be diluted to make 200 gals. of spray solution.

WATSON (J. R.). *Icerya purchasi* **in Florida, United States.**—*Internat. Rev. Science & Practice Agric., Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, vii, no. 7, July 1916, p. 1063. [Abstract from *Univ. Florida, Agric. Expt. Sta., Rept. for 1914, Tallahassee*, 1916, p. 55.] [Received 30th November 1916.]

The spread of *Icerya purchasi* continues with increasing rapidity in Florida. From August 1913 to March 1914 it was discovered in nine localities. The damage has been very serious, especially at Key West, where this scale even attacks *Bursera simaruba*, which must be added to the list of host-plants.

BAKER (A. C.) & TURNER (W. F.). **Rosy Apple Aphis.**—*Jl. of Agric. Research, Washington, D.C.*, vii, no. 7, November 1916, pp. 321–343, 6 plates.

The authors discuss at some length the nomenclature of the Aphid known as the rosy apple aphis, and arrive at the conclusion that *Aphis malifoliae*, Fitch, is the correct name for it. *Aphis pyri*, Boyer, was the earliest name used for the American rosy aphis, but as the original description does not apply to the insect under consideration, this name cannot be used. Koch, in redescribing *A. crataegi*, Kalt., as well as *A. pyri*, Boyer, based his descriptions entirely upon apple forms, and these agree very closely with the authors' insect, so that *A. crataegi*, Kalt., and *A. pyri*, Boyer, appear to be distinct species,

while *A. pyri*, Boyer, of Koch is *A. malifoliae* of Fitch. *A. pyri*, Koch, is however an entirely different species, and the name being preoccupied, has been renamed *A. kochi* by Schouteden, though Theobald has treated *A. malifoliae*, Fitch, as a synonym of *A. kochi*, Schout. [see this *Review*, Ser. A., iv, pp. 396]. Though *A. sorbi*, Kalt., is the name now most commonly applied to the American rosy apple aphis, the description does not apply in every particular to the authors' insect, and these differences, and the examination of European examples, lead them to believe that they are dealing a with distinct species. *Myzus plantaginis*, Pass., common on broad-leaved plantain in the U.S.A., must also be distinguished from *A. malifoliae* occurring on plants of the same genus.

A. malifoliae is abundant in some of the northern States and also occurs in Quebec, Ontario and British Colombia. A description of the various stages is given. The eggs are laid mostly on small twigs, under buds, or in crevices in the bark, and hatching begins early in April and continues for about a week. The first stem-mothers begin to reproduce about 25th April. The first generation is wingless, while in each succeeding generation the percentage of winged insects increases until all are winged. Migration to plantains begins about 20th May, and most of the insects have left the apple by about 20th June. From 4 to 14 generations of the summer form occur, these being practically all wingless. The first autumn migrants become adult about the second week in September and remain on the trees after 1st November. Production of oviparous females begins about mid-September, and is at its height about mid-October. Males begin to appear early in October, at the time the oviparous females begin to become adult, and are most numerous at the end of October and early in November. Oviposition begins in mid-October and continues till the oviparous females are all dead.

This Aphid causes the leaves to curl, and in very young trees the growing tips of the branches are also attacked, with the result that they become twisted and permanently deformed. The fruit, when attacked, is of small size and irregular shape.

A bibliography of 12 works is given.

SILVESTRI (F.). **Sulle Specie di Trypaneidae (Diptera) del Genere** *Carpomyia* **dannose ai Frutti di** *Zizyphus*. [Note on the TRYPETIDAE of the Genus *Carpomyia* which are injurious to Fruits of *Zizyphus*.]—Separate, dated 18th October 1916, from *Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric., Portici*, xi, pp. 170–182, 9 figs.

The genus *Carpomyia*, Rond., is at present represented by two species, the larvae of both of which live in the fruit of some species of *Zizyphus*. This paper describes for the first time the larvae of both species, with figures of the adults. *C. vesuviana*, Costa, has been reported from south Italy, Dalmatia and India and probably occurs in all those regions of southern Europe and Asia where its food-plants grow. The larvae of *C. vesuviana* infest *Z. sativa* in Italy, and *Z. jujuba* in India. Near Portici the adults appear from the second half of June till a little after mid-July. The eggs are laid within a few days of emergence. After feeding, the larva migrates to the ground, where it pupates and passes the winter. There is thus one generation a year in

Italy. In India, Fletcher has bred from *C. vesuviana*, *Bracon fletcheri*, Silv., and *Biosteres carpomyiae*, Silv. *C. incompleta*, Becker, was described from a specimen taken near Suez. It has also been found in south Italy on *Z. sativa*, in the Sudan and in Eritrea on *Z. spinachristi*. Its habits are similar to those of *C. vesuviana*. In Italy the author bred from it the Chalcid, *Eupelmus urozonus*, which parasitises many other insects, including *Dacus oleae*. From pupae collected in Eritrea in 1914 several examples of *Opius concolor*, Sz., were obtained and also two females of a species of *Tetrastichus* allied to *T. giffardianus*, Silv. Marchal bred *O. concolor* from pupae of *D. oleae* collected in Tunisia, and it has also been recorded in Tripoli. A bibliography of 14 works completes this paper.

EMELEN (A. van). *Trigona* **versus** *Apis.—Chacaras e Quintaes, São Paulo*, xiv, no. 4, 15th October 1916, pp. 758–759.

The destruction of a colony of *Apis mellifica* (honey bee) by the native bees, *Trigona amalthea*, Ol., and *Melipona* (*T.*) *williana*, Friese, is reported from Cachoeira Grande on the Amazon. An attempt to introduce colonies of *Apis ligustica* into the Ceará district is also stated to have been unsuccessful owing to the attacks of native bees.

MALENOTTI (E.). *Prospaltella fasciata*, **Malen., n. sp.**—Separate, dated 25th October 1916, from *Redia, Florence*, xii, no. 1, pp. 195–196, 1 fig.

A description is given of *Prospaltella fasciata*, sp. n., bred from *Chrysomphalus dictyospermi* infesting *Sanseviera arborescens* at Florence.

Insect Pests of Tea.—*Rept. Dept. Agric., Ceylon, for the Period January 1st 1915 to December 31st 1915, Colombo*, pp. C2–C3. [Received 7th November 1916.]

It is stated that Mr. E. R. Speyer has discovered that the true host-plant of the shot-hole borer of tea [*Xyleborus fornicatus*] is the castor-oil plant, *Ricinus communis*. Swarms of these beetles emerging from this plant establish themselves in the tea trees, and even at altitudes where tea is found to be immune, the beetle is found in castor. The only remedy is complete extermination of this plant throughout the whole tea-growing area. It is also proposed to break up the vast tea areas by shelter belts of immune trees and undergrowth, in order to check migration and facilitate control. Wind belts have been also recommended for controlling the tea tortrix [*Homona coffearia*], and the opinion is now held that this pest must also be made the subject of special investigation.

HENRY (G. M.). **Abstract from the Report of the Assist. Entomologist.**—*Rept. Dept. Agric., Ceylon, for the Period January 1st 1915 to December 31st 1915, Colombo*, p. C12. [Received 7th November 1916.]

The following pests are recorded as occurring in various districts in Ceylon:—On tea: *Zeuzera coffeae*, Nietn., which is only a serious pest in nurseries; *Heterusia cingala*, Moore, which was rather severe in

November; *Natada nararia*, Moore; *Orgyia postica*, Wlk.; Lamellicorn larvae; *Eriophyes* (*Phytoptus*) *carinatus*; *Helopeltis antonii*; *Calotermes militaris*.

On *Hevea*: a mollusc, *Mariaella dussumieri*, various SCOLYTIDAE, *Saissetia* (*Lecanium*) *nigra* and the Longicorn, *Batocera rubus*, which is the most insidious pest of this tree in Ceylon, but is not yet numerous.

On coconuts, *Nephantis serinopa*, Meyr., and *Rhynchophorus ferrugineus*. On rice, an outbreak of *Leptocorisa varicornis* was controlled by hand netting.

An Entomological Demonstration Train.—*Directors' Report, 1914–1915. Kansas Agric. Expt. Sta., Kansas State Agric. Coll, Manhattan*, 1916, p. 32.

The Experiment Station, the Extension Division of the College and the Santa Fé Railway ran a special train for five days in June 1915, just prior to the harvest, for the purpose of disseminating information regarding the Hessian fly [*Mayetiola destructor*]. By this means 7,000 persons received instruction in control methods.

DEAN (G. A.) & NABOURS (R. K.). **A New Air-conditioning Apparatus.**—*Directors' Report 1914–1915. Kansas Agric. Expt. Sta., Kansas State Agric. Coll., Manhattan*, 1916, pp. 46–54, 4 figs.

The absolute necessity of accumulating data relating to the influence of moisture and temperature on animal life has led to the installation at the Kansas Agricultural Experiment Station of a machine that automatically treats the air before it enters the insect breeding chamber, and forces it through at a rate causing a complete displacement every minute or even more often. A general account of this apparatus is given. In the entomological investigations, valuable results have been secured in the life-history studies of the Hessian fly [*Mayetiola destructor*]. With an optimum temperature this Cecidomyid can pass through its entire life-cycle in from 23 to 24 days, and thus it is clearly indicated that with climatic conditions such as are often experienced in Kansas it is possible for from one to five broods to occur in a single season. Field studies during the past eight years have indicated that on several occasions more than two broods occurred. The presence of moisture in the form of dew was found not to be necessary to the larva, which can itself secrete moisture. Studies of the life-history of several other pests of important crops are contemplated.

MUIR (F.) & SWEZEY (O. H.). **The Cane-borer Beetle in Hawaii and its Control by Natural Enemies.**—*Rept. Hawaiian Sugar Planters Assoc. Expt. Sta., Honolulu*, Entom. Bull. no. 13, September 1916, 102 pp., 4 figs., frontispiece, 3 plates, 1 map, 7 appendices. [Received 21st November 1916.]

The sugar-cane borer (*Rhabdocnemis obscurus*) occurs in Christmas Island, Guam, Bonin, Amboina, Ceram, Kei, Timor Laut, New Guinea, New Ireland, Fiji, Samoa, Tahiti, Gambier and the Hawaiian Islands, as well as in the northern portions of Queensland. The same or a closely allied species is also known from Celebes, Batchian and Mysol. Its original habitat was probably New Guinea and the

adjoining islands, and its original food-plants, sago and other palms, as well as bananas. It was probably introduced into the Hawaiian Islands with sugar-cane from Tahiti in 1854. Fiji and Bonin probably received it from Hawaii with seed cane, and it reached Formosa from Honolulu. It was introduced into Australia from New Guinea also in seed cane.

Natural enemies, which have been introduced into the Hawaiian Islands from various sources, include the Histerid beetle, *Plaesius javanus*, brought from Java to Honolulu, where it has apparently not established itself; its introduction into Fiji has been more successful [see this *Review*, Ser. A, ii, p. 507], though the final result has not yet been reported. Another Histerid, *Platylister abruptum*, has been introduced into Honolulu from Amboina via Macassar, Hong Kong and Japan, but this also has apparently not been established. Though the Elaterid, *Simodactylus* sp., has not been recovered since its introduction, it may yet be found to have established itself. A species of *Chrysopila* is numerous, feeding on Coleopterous and Dipterous larvae on palms and bananas, and Jepson has recorded *C. ferruginosa* attacking larvae of *Cosmopolites sordidus* and *Odoiporus longicollis* (*Sphenophorus planipennis*). The Tachinid, *Ceromasia sphenophori*, Vill., is the only direct insect parasite of *R. obscurus* which has been found. It was first discovered in Amboina and afterwards in Ceram and New Guinea. Its transportation to Hawaii was effected by means of breeding stations established in Queensland and Fiji, puparia being sent from Port Moresby, New Guinea, in the first instance to Queensland and thence to Fiji and so on to Honolulu. It has also been sent to Samoa and Fiji. The larval stage of this fly lasts about 20 days and the pupal about 15 days.

The habits and life-history of *R. obscurus* are given in detail. In Hawaii its chief food is sugar-cane, especially the softer varieties, though it sometimes attacks palms, bananas, papaw and maize, but seldom does any damage to these. No accurate estimate of the annual loss to the sugar industry in Hawaii by this pest can be given, but it is probably not less than £200,000. The artificial methods of control recommended are: The burning of trash and firing of cane before harvesting; stripping dead and dying leaves; the use of baits composed of pieces of split cane placed in heaps along the edges of the fields; hand-picking the weevils by women and children; and the selection of suitable varieties of cane. The natural enemies present in Hawaii are of minor importance. They include the predaceous Elaterid, *Monocrepidius exul*, ants, an Acarid, rats, a mongoose, toads, the mynah bird, and a parasitic fungus.

The history of the breeding and distribution of *Ceromasia sphenophori* in Hawaii is described fully, and the benefits derived from its introduction up to 1914 are summarised [see this *Review*, Ser. A, iii, p. 133]. At the present time this Tachinid is considered to have reached its maximum efficiency. A bibliography of 32 works relating to *R. obscurus*, and eight relating to *C. sphenophori* conclude this bulletin.

In the appendices, which are reprints of earlier circulars, Mr. Muir describes his itinerary in South China when searching for *Perkinsiella saccharicida*. This insect was eventually found in small numbers, as well as two new species of sugar-cane leaf-hoppers nearly related to it, viz.:—*Dicranotropis muiri*, Kirk., and *Perkinsiella sinensis*, Kirk. Two

Dryinid parasites of *P. saccharicida* were also obtained. The natural control of *P. saccharicida* and its allies in China is chiefly due to egg-parasites, which appear to be the same species as those found in Queensland and Fiji. Two or three species of Coccinellids feeding on Aphids and young hoppers were observed. Generally speaking the agents affecting the control of *P. saccharicida* in Australia, China, the Malay Peninsula and Java are the same, and these or nearly allied parasites also infest *P. vitiensis* in Fiji, *P. sinensis* in China, and *P. vastatrix* in Java. *Chrysomphalus aonidum* and *Lepidosaphes pinnaeformis* were found in China in small numbers, as well as parasites infesting them. *Parlatoria ziziphus* is more abundant, but is also kept under control by parasites. Leaves and branches bearing these scales were forwarded to Honolulu in the hopes of establishing the parasites. A near ally of *Dacus cucurbitae* attacks melons and cucumbers in China, and a beetle nearly related to the Japanese beetle, *Adoretus umbrosus* var. *tenuimaculatus*, was found on grape-vines.

Another appendix describes the author's journey from Singapore via Kuala Lumpur to Java, where he visited Batavia and Buitenzorg and various experimental stations throughout the Island. In the Malay States enquiries were first made as to the occurrence of *R. obscurus*, but it appears to be unknown there in sugar-cane, though two allied species, *Cosmopolites sordidus* and *Rhyncophorus ferrugineus*, occur in bananas. *Perkinsiella saccharicida* was one of the first insects found, and a Coccinellid, probably *Cryptolaemus montrouzieri*, was found to be very active in keeping down the cane coccus [*Pseudococcus sacchari*]. At the West Java Station at Pekalongan sugar-cane is very free from insects, but the leaves are frequently spotted and striped with yellow marks which are probably due in part to leaf-hoppers, especially *Phenice moesta* and other insects. Three undetermined leaf-hoppers allied to *P. saccharicida* were also observed. These were controlled to a considerable extent by egg-parasites, apparently closely allied to the Chinese species, and were also attacked by a Dryinid and a Stylopid. The larvae of three large beetles, *Xylotrupes gideon*, *Oryctes rhinoceros* and *Rhynchophorus ferrugineus*, were occasionally found in the stems of sugar-cane. These palm beetles are very common and do a large amount of damage to young palms. They are preyed upon by the larvae of two or three carnivorous beetles. *Rhabdocnemis obscurus* is unknown in Java, the worst insect pests being moth-boring larvae and a beetle larva of the genus *Anomala*. A weevil, said to be *Cryptorrhynchus mangiferae*, and *Dacus ferrugineus* attack mangos.

Having failed to find *R. obscurus* in Java, the author visited one or two areas in Borneo. No examples could be found, but *C. sordidus* and *R. ferrugineus* occurred in banana and palm trees, attended by Hydrophilids and Histerids as in Java. No direct parasites were found. At Telok Ayer, *Perkinsiella vastatrix* was found in sugar-cane with its attendant egg-parasites.

On the assumption that the natural home of *R. obscurus* is either the western or middle portion of the Malay Archipelago, where it is uncommon owing to its being kept under control by natural enemies, and that it has travelled eastward unaccompanied by these, the author decided to investigate the islands to the west of New Guinea, where it is reported to be common and destructive. In Amboina *R. obscurus*,

or a closely allied species, was found only in small numbers on a second visit, though the same species was abundant in Larat, especially in sago and betel-nut palms. *P. vastatrix* was present and also another dark-coloured hopper, the eggs of which were heavily parasitised by several species of *Pipunculus* as well as by Dryinids. The larvae of a Lycaenid and a small moth were found feeding on a white scale.

In New Guinea sugar-cane was found to be badly bored by a moth nearly allied to *Diatraea striatalis.* Its eggs and larvae are parasitised by a Tachinid, which again is heavily parasitised by a small Hymenopteron. *P. vastatrix* was found on sugar-cane, but was kept down by egg-parasites very similar to those imported into Honolulu from Queensland and Fiji.

At Laloki, Papua, the sea-island cotton was infested with two species of cotton stainer. The cotton boll-worm, *Heliothis obsoleta* (*armigera*) was scarce.

In the last appendix, Mr. Muir describes his second visit to New Guinea to obtain a fresh supply of *Ceromasia sphenophori*, having arranged for an intermediate breeding station in Queensland. Ultimately it was found necessary to establish a second breeding station in Fiji, and from here the Tachinid was successfully transferred to Honolulu. On this journey five new sugar-cane leaf-hoppers of the genus *Perkinsiella* were discovered.

Enslin (E.). **Die europäischen** *Diprion* (*Lophyrus*) **Arten.** [The European Species of *Diprion* (*Lophyrus*).]—*Naturwissenschftl. Zeitschr. f. Forst- u. Landwirtschft, Stuttgart,* xiv, no. 1, January 1916, pp. 1–20, 1 plate. [Received 25th January 1917.]

It is pointed out that the generic name *Lophyrus*, Latr., 1802, is preoccupied, having been given to a genus of Mollusca by Poli in 1791. It must therefore be replaced by *Diprion*, Schr. The various species of this genus are not easily recognisable by forest entomologists from the existing literature, though there are 15 distinct European forms. This systematic paper enables the females to be accurately determined, though more difficulty will be experienced with the males, in which in some cases good characters for differentiation have not yet been found. No key to the larvae is given, the reader being referred to a previous work of the author's (Die Blatt- und Holzwespen, Stuttgart, 1914, Bd. iii of "Die Insekten Mitteleuropas, insbesondere Deutschlands"). Little work has been done on the *Diprion* larvae since the time of Hartig, and as his work is still serviceable, the present paper contains a few remarks only on such larvae as Hartig either did not describe, or described inaccurately. The larva of *D. pallipes*, Fall., often has the head entirely black and is liable to be mistaken for that of *D. simile* or *D. sertifer*, though it may be distinguished by the colour of its body and by its small size. The larva of *D. fuscipenne* is one of three species living on the fir, the two others being *D. polytomum* and *D. abieticola*, which live on *Abies excelsa*. The larvae of *D. pallidum* vary in colour, but in a given colony the individuals are usually of the same colour. The darker forms resemble *D. frutetorum*, but differ in the large black spines being visible to the naked eye. It is still considered impossible to distinguish between the larvae of *D. virens* and *D. laricis*. Repeated breeding experiments have shown that some of the differences given

by Hartig are not admissible. The larvae of *D. variegatum* and *D. frutetorum* were confused by Hartig, who was indeed unable to divide these two species. It should be noted that the larvae of *D. variegatum* (also placed under *D. frutetorum* by Hartig) are very like those of *D. virens* and *D. laricis*, from which, according to Hartig, they differ in that the darker green dorsal stripe is not divided, or only so on the first two segments. In the case of the larvae bred by the author, a darker green, divided dorsal stripe occurred on the first two to four segments and then disappeared, the remaining segments being unstriped (contrary to what occurs in *D. virens* and *D. laricis*), though the dark dorsal aorta simulates a dorsal stripe. The larva of *D. frutetorum* (described by Hartig as that of *D. variegatum*) is usually included among the smooth-bodied larvae, but in reality it has distinct black spines, which, however, are only visible under a lens. Those who desire more information on the morphology of these saw-flies are referred to the author's work mentioned above and to a paper by him, Die Tenthredinoidea Mitteleuropas I, which appeared as a supplement to the Deutsche Entomologische Zeitschrift, 1912. The keys given are supplemented by figures and deal with the following species :—*D. nemorum*, F., *D. pallipes*, Fall., *D. fuscipenne*, Forsius, *D. sertifer*, Geoffr. *D. pallidum*, Kl. *D. fennicum*, Forsius, *D. polytomum*, Htg., 1834 (*hercyniae*, Htg., 1837), *D. virens*, Kl., *D. pini*, L. (*eques*, Schrank, *dorsatum*, F., *nemorum*, Fall., nec F.), *D. simile*, Htg. (*eremita*, Thoms.), *D. socium*, Kl., *D. variegatum*, Htg. (*thomsoni*, Knw.), *D. abieticola*, D. T. (*abietis*, R. V. Stein, nec Harris), *D. laricis*, Jur., *D. frutetorum*, F.

BAER (W.). **Ueber Nadelholz-Blattwespen.** [The Saw-flies of Coniferae.]—*Naturwissenschftl. Zeitschr. f. Forst- u. Landwirtschaft, Stuttgart*, xiv, nos. 7–8, July–August 1916, pp. 307–325. 5 figs. [Received 1st November 1916.]

The first section of this paper deals with the Lydids infesting firs, the known species of which belong to the genus *Cephaleia*, and are no longer included in the genus *Lyda*, now *Acantholyda*, which comprises species infesting the pine, such as *A. stellata*, *A. erythrocephala* and *A. hieroglyphica* (*campestris*). *L. hypotrophica*, Htg., has been found to be a synonym of *Tenthredo abietis*, L., and this pest should now be known as *Cephaleia abietis*, L. The genus *Cephaleia* comprises six species native to Germany ; two are rarities, and the other four, *C. alpina*, Kl. (*lariciphila*, Wachtl), *C. erythrogastra*, Htg., *C. abietis*, L., *C. arvensis*, Pz. (*signata*, F.)—are of importance in forestry. They are very similar morphologically and a key to them is given. Their biological characteristics are, however, more marked. *C. alpina* does not live on the fir, but on the larch. Whilst chiefly occurring in Alpine regions, it has followed the larch to new plantations elsewhere. In Austrian Silesia the flight period was noticed at the end of April and early in May, and the damage done became noticeable owing to the larches turning brown early in July. Of the other three species, *C. abietis* is specially characterised by its gregarious habits in the larval stage. In the case of the two remaining species, *C. arvensis* and *C. erythrogastra*, the eggs are laid singly and are usually found on needles of the spring growth and not on those of the preceding year, as are the eggs of *C. abietis*. These larvae feed mostly

on the May growth and their work extends towards the base, whereas that of *C. abietis* extends towards the tip. The webs of *C. arvensis* are loose like those of *C. abietis*, but differ in being kept free from excreta and thus resemble those of *Acantholyda stellata* on the pine. The web of *C. erythrogastra* is very remarkable and constitutes the chief biological peculiarity of this species. When completed, it is a solid tube at least as long as the larva, free from excreta and composed of a dense papery mass of a vivid red-brown colour. The flight period of these sawflies is an extended one. The males are on the wing on fine days in April; mating has been observed as late as the end of July in the case of *C. arvensis*, while very young larvae of *C. erythrogastra* were present at that time. The flight period of *C. abietis* tends to be restricted to June in mountain districts, probably owing to the shorter summer. These areas are the real habitat of this species, whereas *C. arvensis* and *C. erythrogastra* occur on the fir both in the plains and in the mountains. The damage they do is usually slight, though a case has been recorded where *C. arvensis* devastated an old fir forest in Jutland.

The second section deals with the genus *Diprion* (*Lophyrus*). Since Hartig's work, this genus had been little studied until Enslin's exhaustive systematic treatise was published [see above]. Nothing much can be added to Hartig's description of the character of the cocoons of the various species. He appears, however, not to have been aware of the mode of pupation of the non-hibernating larvae of *D. pallidum*, Kl. After living gregariously, they assemble at the tip of the pine twigs and spin their cocoons near the end shoot, thus causing a peculiar appearance which at once indicates the species. There is still some uncertainty with regard to the larvae of *D. virens*, Kl., *D. laricis*, Jur., and *D. variegatum*, Htg. (*thomsoni*, Knw.). It has been said that those of *D. virens* and *D. laricis* are indistinguishable; but the author disagrees with this, as the *D. virens* larvae have two distinctly visible, thin, dark, widely separated dorsal lines, while those of *D. laricis* have only one broad dark line, which only in one portion appears to be slightly divided. In any case, in *D. virens* the total width of the two narrow lines together with the space between them is greater than the width of the corresponding mark in *D. laricis*, being over one-third of the breadth of the back in the former and under one-quarter in the latter. Should these proportions be constant, they will provide an easy means of distinguishing the two species. A further difficulty may, however, arise as regards the distinction between *D. laricis* and *D. variegatum*. Some account is given of the character of the eggs and the method of oviposition of this genus, though comparatively little is known about these points. The eggs, especially of *D. pini*, *D. sertifer* and *D. pallidum*, are at times very heavily parasitised by what is believed to be a species of the Chalcid genus *Tetracampe*, Först. According to Borries, this is a general saw-fly egg-parasite and not confined to the species attacking conifers. It is noted that the Weymouth pine is very attractive to *D. simile*, whereas *D. pini* can scarcely be persuaded to leave the forest pines (in Germany), and only rarely occurs on the mountain pines growing near by. Observations in the Tharandt district have confirmed the fact that *D. sertifer* has only one flight period rather late in the year and that it hibernates in the egg-stage, which is not usual with saw-flies. This species occurs at higher elevations and farther north than any other

species and accompanies the pine to its limits. The other species of *Diprion* have two generations a year in Germany. Since the planting of pines was carried out in Denmark, species of *Diprion* have appeared, apparently coming from south Sweden. In Denmark, *D. pallidum* alone has two generations, the others only one—probably as an adaptation to the northern climate.

The third part of this paper deals with the Nematids of the larch and fir. Of the three forest larch Nematids, *Lygaeonematus wesmaeli*, Tischb., is the least known. In June 1908 the author found considerable damage by this species in a plantation of vigorous 6–9 foot larches in Oberlausitz. Only the fresh and still very sappy, long shoots were attacked, all the needles being removed. Up to this point the damage resembles that done by *L. abietinus*, Christ (*Nematus abietum*, Htg.) on the May growth of the fir. At the time of inspection in June, numerous females were still around the larches, so that it is possible that with a great increase of numbers the attack may also extend to the short shoots, as in the case of *L. laricis*, Htg. This is, however, in sharp contrast to the injury caused by *L.* (*Holcocneme*) *erichsoni*, Htg., which oviposits on the ends of the long shoots and then migrates to the short ones. *L. wesmaeli* has only a single generation, while *L. laricis* has two. The author has not succeeded in distinguishing the larvae of these two species with any certainty.

Tubeuf (Elisabeth v.). **Die Weisspunktkrankheit und ihre Erreger.** [The Whitespot Disease and its Cause.]—*Naturwissenschaftl. Zeitschr. f. Forst- u. Landwirtschaft, Stuttgart*, xiv, no. 9, September 1916, pp. 436–446, 5 figs. [Received 1st November 1916.]

A whitespot disease occurring on a number of plants was found in 1916 to be due to infestation by Jassid larvae, which were associated with Aphids. These have been determined by Dr. Melichar as those of *Typhlocyba rosae*, *T. ulmi*, *Chlorita flavescens*, *Eupteryx loewi* and *E. concinna*.

Schaffnit & Lüstner. (1) **Bericht über das Auftreten von Feinden und Krankheiten der Kulturpflanzen in der Rheinprovinz im Jahre 1913.** (2) **Berichte über Pflanzenschutz der Pflanzenschutzstellen an der Kgl. Landw. Akademie von Bonn-Poppelsdorf und an der Kgl. Lehranstalt für Obst- u. Gartenbau Geisenheim.** [(1) Report on the Occurrence of Enemies and Diseases of cultivated Plants in the Rhine Province in 1913. (2) Reports on Plant Protection of the Plant Protection Stations at the Royal Agricultural Academy at Bonn-Poppelsdorf and at the Royal School for Fruit and Garden Cultivation at Geisenheim.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxvi, no. 3–4, 1st June 1916, pp. 194–196. [Received 1st November 1916.]

This paper is an abstract from the three original reports.

Many methods of control were tried against the vine moths, *Clysia ambiguella* and *Polychrosis botrana*. The latter is becoming increasingly dangerous in the middle Rhine vine-growing areas, particularly in the valley of the Rhine. Nicotine solutions and powders usually give the best results against it. To control *Otiorrhynchus sulcatus*, the ground around the vines was dug up to a depth of about 6 inches, stones were

removed and replaced with rich soil and the weevils were searched for daily. The vines were treated with ammonium sulphate and 40 per cent. potash salts. This treatment must be carried out repeatedly during the summer and stable manure should not be used in the years following. *Pulvinaria vitis* may be controlled by thorough scrubbing and spraying with a 15 per cent. carbolineum solution. *Nysius senecionis* was recorded for the first time as a vine pest in Germany at Walporzheim, where, owing to lack of food, it migrated from *Senecio vulgaris* to the vines. *Cydia pomonella* and *C. funebrana* are specially dangerous in Rheingau because they have two generations; the second generation of moths occurs in August and is usually more numerous and harmful than the first. The first appearance of *Cheimatobia brumata* is usually between 28th October and 4th November. Sparrows do useful work in destroying this moth, especially at nesting time. The raspberry beetle, *Byturus fumatus*, was noticed on apple blossoms.

WAHL (C. v.) & MÜLLER (K.). **Bericht der Hauptstelle für Pflanzenschutz in Baden an der Grossherz. landw. Versuchsanstalt Augustenberg für das Jahr 1914.** [The Report for 1914 of the chief Plant Protection Station in Baden, at the Augustenberg Agricultural Experiment Institute of the Grand Duchy.]—*Eugen Ullmer, Stuttgart*, 1915. (Abstract from *Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxvi, nos. 3–4, 1st June 1916, pp. 196–197.) [Received 1st November 1916.]

In the dry autumn of 1914 large numbers of a mite, *Phyllocoptes fockeni*, appeared on *Prunus domestica*. Many of the insecticides tested proved ineffective. Kellers spray for Aphids only gave insufficient results, and both "katakilla" and "contraphin," prepared by Messrs. MacDougal, of Manchester, require to be used at a greater concentration against plant lice than recommended in the instructions.

Lyda hypotrophica, **a Hymenopterous Pest of** *Epicea* **in the Forests of Roggenburg, Germany.**—*Internat. Rev. Science & Practice Agric., Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, vii, no. 7, July 1916, pp. 1064–1066. (Abstract from *Zeitschr. f. angewandte Entomologie, Berlin*, iii, no. 1, March 1916, pp. 75–96.) [Received 30th November 1916.]

A detailed description is given of the occurrence of *Cephaleia abietis*, L. (*Lyda hypotrophica*, Htg.) in the forest of Roggenburg, Suabia, and the damage it has occasioned of recent years. The observations were made in the Royal Forest of Breitenthal, but are typical of the whole of Suabia. In August 1911, in a stand of *Epicea* 119 years old, many trees were remarked with their tops and sides entirely stripped of needles. The injury was at first ascribed to the excessively dry weather, but on felling the trees, it was found to be due to this sawfly. Stands of from 60 to 120 years old suffered most, as the majority of the larvae generally live in that part of the soil which is shaded by the largest trees. A series of observations were made as to the average number of larvae present in the soil. No stand throughout the Royal Forest District, comprising 5,683 acres; was entirely free from larvae, independently of the age of the trees. Taking 100 as the basis of the number found in 1911, this had fallen 19·5

per cent. in the spring of 1912 and 47·5 per cent. in that of 1913. As control was only begun in 1913, this reduction was evidently due to natural factors. Though Lang has shown that in the forests of Upper Franconia the larvae of *Raphidia ophiopsis* attack the eggs and young larvae of *C. abietis*, this enemy could not be held accountable for the decrease, as it was only rarely found and only a small number of Ichneumonid parasites were obtained from a large number of larvae during 1912–1913. At the end of 1914, however, the number of Ichneumonids present in some parts of the forest was considerable. According to Baer, an Ichneumon, *Polycinetis aethiops*, attacks the nearly full-grown larvae. Though great injury was done to the trees in the forest of Roggenburg, they were not killed, and in 1913 the damage had disappeared to a great extent, only the lower branches and those in the interior of the tree retaining their bare appearance.

It is generally supposed that the larva destroys the needles during June, July and the beginning of August and afterwards shelters in the ground, but this is only partly correct, as some larvae remain longer on the tree than others; in one case the destruction of the needles continued right up to December. Effective control hinges on an early knowledge of the date of the flight period. Whether the flight in spring will be considerable or not may be determined in the preceding autumn by observing the so-called pupal eyes. According to Scheidter, larvae that are quite mature exhibit deep black oval spots above the eyes representing the eyes of the future pupa. The author believes this to be only partly correct, as these markings do not appear only just before pupation, but as early as the previous autumn or summer, and larvae with pupal eyes were found in the month of August 1913. A high temperature in April was found to favour pupation. The pupal stage in the soil is very short, especially in fine weather. Mating takes place on the ground and on grasses and very rarely in the crown of the tree.

In the forest of Roggenburg sticky bands about 5 feet above the ground proved very successful at the beginning of a flight. The females rarely fly to the tree-tops, most of them climbing up the trunks. Later on, when the weather allowed the insects to emerge in large numbers, and the ovaries of the females were full of eggs, the females succeeded in crossing the bands without being captured. These observations are not in accordance with those of many investigators and require to be continued. Fly-papers gave excellent results, and though their cost prohibited experiments on a large scale, they showed that a substance with the properties of the adhesive used for trapping flies is also suitable against these insects.

Forbes (S. A.). **Recent Illinois Work on the Corn Root-aphis and the Control of its Injuries.**—*Twenty-eighth Report of the State Entomologist of the State of Illinois, Urbana, 1915*, pp. 1–62, 18 figs. [Received 2nd December 1916.]

The corn root-aphis, *Aphis maidiradicis*, is the most generally injurious pest of maize fields in Illinois [see this *Review*, Ser. A, Vol. i, p. 124]. The key to its control is found in the spring condition of this pest in old maize fields infested in the previous year and in the fact that maize is the only crop on which it feeds. The principal measures

both against this Aphid and the ants associated with it are therefore rotation of crops, early and deep ploughing and the use of repellents at planting time. These should not be used by direct application to the seed, but by previous mixture with chemical fertilisers. Autumn ploughing and one spring disking are much more effective than spring ploughing with no disking. Change of maize ground to oats for one year, and autumn ploughing of the oat stubble, gave a 25 per cent. larger yield than adjacent ground kept continuously under maize. The root infestation of young maize on oat stubble is one-tenth that of plants on old maize ground.

FORBES (S. A.). **Observations and Experiments on the San José Scale.** —*Twenty-eighth Report of the State Entomologist of the State of Illinois, Urbana, 1915,* pp. 63–79, 2 figs. [Received 2nd December 1916.]

This paper deals with a series of experiments begun by the late Mr. J. A. West and completed by Messrs. W. P. Flint and L. M. Smith in connection with the San José scale [*Aspidiotus perniciosus*]. It has been found that this scale may live and reproduce freely on ripe apples picked from the tree and kept at ordinary room temperatures, and that living young may continue to be produced under such conditions during a period of eight weeks. Infested apples taken from cold storage in December gave similar results, young being produced on these apples for 25 days. Breeding experiments conducted with the object of distinguishing the descendants of the first born from those of the last born of each generation, gave two successive generations of the last born series in the complete year, and four such generations of the first born series. The potential rate of multiplication under optimum conditions is shown to be 32,791, 472 to 1 for the year.

Spraying operations with various preparations of lime and sulphur and with two brands of miscible oils justify the usual preference for the sulphur solutions, especially owing to their more prolonged effect when applied in spring. The home-made solutions were as effective as the ready-made ones requiring only dilution for use. The great advantage of early spraying over autumn spraying is emphasised, the effectiveness of the former being some 20 per cent. greater. The possibility of restoring a badly infested orchard, and maintaining it in good condition with one or two sprayings a year, is considered to be well established.

FORBES (S. A.). **Life-history and Habits of the Northern Corn Root-worm** (*Diabrotica longicornis*, **Say**).—*Twenty-eighth Report of the State Entomologist of the State of Illinois, Urbana, 1915,* pp. 80–86, 1 fig. [Received 2nd December 1916.]

In the course of some experiments with *Diabrotica longicornis*, no evidence of the occurrence of more than one generation in the year was obtained.

The effect of the rotation of crops on damage by this beetle is shown by observations made in the amount of injury in seventy-one fields in which maize had been grown for one, two or more years. It was found that ground on which maize is grown for the first year after rotation with other crops will not be injured at all; maize grown for a second year on the same ground is likely to become infested to an average

extent of 19 per cent., and in the third year at two and a half times that rate. Maize should therefore not be grown for more than two years on the same ground where this pest is prevalent.

Observations made to determine whether the beetles found feeding on clover flowers, etc., outside the maize fields from which they have emerged, oviposit before leaving them or return later to do so, have produced no definite results. No trace of injury or under-ground infestation of any other plant than maize was found, even when the roots of such plants were intermingled with those of badly infested maize.

Glenn (P. A.). **The San José Scale** (*Aspidiotus perniciosus*, **Comstock**).—*Twenty-eighth Report of the State Entomologist for the State of Illinois, Urbana, 1915,* pp. 87–106, 2 figs., 4 plates. [Received 2nd December 1916.]

The San José scale is known to infest about one hundred and fifty kinds of trees and shrubs. On some it multiplies rapidly and causes serious injury; on others it rarely becomes abundant enough to be dangerous; while on a third class it cannot permanently maintain itself. Some of the more important trees and shrubs which are likely to be seriously injured are:—Apple, peach, pear, plum, and sweet cherry, with their nearly related wild and ornamental species; currant, dogwood, Japan quince, june-berry, lilac, hawthorn, European purple-leaved beech, flowering almond, rose, snowberry, buckthorn, young poplar, young elm, willow, mountain ash, linden, and Osage orange.

The following become infested when surrounded by badly infested trees, but are rarely seriously injured: sour cherry, Kieffer pear, blackberry, raspberry, dewberry, mulberry, grape, maple, chestnut, horse-chestnut, birch, catalpa, ash, locust, walnut, Virginia-creeper, *Deutzia*, *Spirea*, persimmon, *Althea*, globe-flower, California privet, honeysuckle, sumac, smoke-tree, and *Wistaria*.

The following seem to be exempt from attack: red bud, yellow wood, Kentucky coffee tree, hickory, butternut, sweet gum, tulip iron-wood, button-wood, oak, *Ailanthus*, papaw, barberry, *Mahonia*, trumpet-vine, bitter-sweet, button-bush, filbert, hazelnut, *Weigelia*, huckleberry, witch-hazel, English ivy, *Hydrangea*, gold-flower, matrimony-vine, mock-orange, and evergreens. Wild crab-apple and hawthorn and a few of the other more or less susceptible trees and shrubs are likely to become infested when growing near orchards, and it is possible that in some localities these susceptible species harbour this scale in forests. Osage orange hedges are liable to become heavily infested and form important foci for the dispersal of this scale. They should therefore be grubbed out or kept trimmed so low that they may be thoroughly sprayed.

The San José scale can only be transferred from one food-plant to another while in the crawling stage. The principal agents of transference are birds, squirrels, insects, man, domestic animals and the wind. In the dormant state it may be carried any distance on nursery stock, cuttings and scions. The natural agencies which materially check its multiplication are climatic conditions, predaceous and parasitic insects, and fungus diseases. The parasites bred from this scale in Illinois in 1914 were *Perissopterus pulchellus*, How., *Aphelinus*

diaspidis, How., *Micropterys* sp., *Signiphora nigrita*, Ashm., *Prospaltella aurantii*, How., *P. perniciosi*, Tower, and *Aphelinus fuscipennis* How.

Preventive measures against dissemination are provided by the annual inspection of nursery stock, and the prohibition of shipment of such stock unless accompanied by an inspection certificate. All nursery stock found infested is destroyed and all stock likely to be infested at the time or liable to become infested before the end of the season is fumigated with hydrocyanic acid gas before shipment. The usual artificial methods of control are recommended, with particulars as to the apparatus and equipment required.

FORBES (S. A.) & GLENN (P. A.). **On the Life-History of the Codling Moth.**—*Twenty-ninth Report of the State Entomologist of the State of Illinois, Urbana, 1916*, pp. 1–21, 10 figs., 2 diagrams.

The extraordinarily hot and dry summer of 1914 had such a stimulating effect on the development of the codling moth (*Cydia pomonella*) in Illinois, that the spraying measures of apple-growers were quite inadequate to cope with it. A further examination of its life-history shows that there are two complete generations of this moth in both central and southern Illinois in a season, and a small or partial third generation further south. The authors are convinced that the successful timing of spraying operations, so that effective poisons shall be on the apples when they are most needed and will be most destructive to the young caterpillars, requires careful and intelligent observation of the course of events for each year, since no two years can be exactly alike. They therefore advise the establishment of a properly equipped observation station with an experienced man in charge for each of the principal fruit sections of the State.

FORBES (S. A.). **A General Survey of the May-beetles** (*Phyllophaga*) **of Illinois.**—*Twenty-ninth Report of the State Entomologist for the State of Illinois, Urbana, 1916*, pp. 23–65, 25 tables.

This paper contains a discussion of the numbers, dates of occurrence, food-plants and distribution in Illinois of the genus *Lachnosterna* (*Phyllophaga*),*based on the study of nearly 119,000 specimens collected between 1905 and 1913. Thirty-four species of May-beetles are recognised in Illinois, viz.:—*Lachnosterna hirticula*, Knoch; *L. implicita*, Horn; *L. fusca*, Froel.; *L. inversa*, Horn; *L. futilis*, Lec.; *L. forbesi*, Glasg.; *L. rugosa*, Melsh.; *L. micans*, Knoch; *L. anxia*, Lec.; *L. bipartita*, Horn; *L. fraterna*, Harr.; *L. profunda*, Blanch.; *L. tristis*, F.; *L. ilicis*, Knoch; *L. fervida*, F.; *L. vehemens*, Horn; *L. crenulata*, Froel.; *L. corrosa*, Lec.; *L. drakii*, Kirb.; *L. congrua*, Lec.; *L. crassissima*, Blanch.; *L. delata*, Horn; *L. nitida*, Lec.; *L. forsteri*, Burm.; *L. horni*, Smith; *L. praetermissa*, Horn; *L. prunina*, Lec.; *L. longitarsa*, Say; *L. arkansana*, Schaef.; *L. villifrons*, Lec.; *L. balia*, Say; *L. barda*, Horn; *L. calceata*, Horn; *L. hirtiventris*, Horn. *L. fusca* and *L. futilis* were much the most destructive in northern Illinois in 1912

* Lacordaire pointed out long ago (Gen. Coleopt. iii, 1856, p. 284) that *Phyllophaga*, Harris, is a *nomen nudum*, and therefore should not be used. —ED.

and these species comprised two-thirds of the collections made in 1914. *L. rugosa*, *L. anxia* and *L. nitida* are also dominant species in northern Illinois. *L. rugosa* feeding on poplar and willow, *L. nitida* on hazel, and *L. anxia* on willow, poplar, apple, oak and linden; *L. fusca*, *L. inversa* and *L. drakii* are numerous in northern and central Illinois; *L. fusca* feeding on poplar, willow, oak, hickory, ash, elm, apple and walnut; *L. inversa* on apple, elm, blackberry and ash; *L. drakii* on willow, poplar, oak, elm, hazel and blackberry. The common species in Central and Southern Illinois are:—*L. hirticula* on oak, hickory, blackberry and other plants; *L. fervida* on oak, hickory, persimmon and willow. The southern species are:—*L. forbesi* on cherry, peach, and apple; *L. micans* on persimmon and oak; *L. bipartita* on willow, hickory, and oak; *L. fraterna*, *L. profunda*, *L. corrosa* and *L. forsteri*, on oak, persimmon, and hickory; *L. crenulata* on persimmon, willow, and hickory; *L. delata* on oak and hickory; *L. praetermissa* on oak, willow and hickory; and *L. vehemens*, the food-plants of which are unknown. Tables are given setting forth the seasonal succession of the species in the different districts for the years 1907–1910, and the dates of collection for various sections of the State. The periods of extraordinary abundance of a species in any locality or district shows little correspondence with any life-cycle. Extensive parasitism of adults and larvae by insects, Annelids, Protozoa and fungi, produces widespread and destructive epidemic diseases, a knowledge of the prevalence and status of which is essential to any safe prediction of periods of destructive abundance of these beetles. In America the so-called "flight year" of the beetles may be predicted for any locality and measures taken accordingly, but in Europe no parasites of the insects of this group are known and there is comparatively little to interfere with the periodical recurrence of seasons of destructive abundance. It is possible that parasites, especially fungi, may be cultivated and distributed and thus assist materially in the control of the insects. A recently discovered Annelid parasitic on the grubs, which is the cause of epidemic destruction among them, may be readily bred and grown in great abundance on raw egg.

FORBES (S. A.). **The Influence of Trees and Crops on Injury by White Grubs.**—*Twenty-ninth Report of the State Entomologist of the State of Illinois, Urbana, 1916,* pp. 66–70.

In fields having trees within or on their borders or within less than an eighth of a mile, white grubs of the genus *Lachnosterna* (*Phyllophaga*) were found at an average rate of 39·17 to the mile; where trees were more than an eighth and less than a quarter of a mile away, the grubs averaged 17·83; more than a quarter of a mile and less than half a mile, 15·94; half a mile or more, 14·4. More eggs were found to be laid in pasture than in any other crop, followed by wheat and oats, fallow ground, clover, maize and other meadow crops in that order. It was found as a result of the extraordinary injury by white grubs in 1912 in Northern Illinois, that of forty-four fields injured, though 80 per cent. were under maize in 1912, only 5 per cent. carried that crop in 1911; whereas only 14 per cent. were under grass in 1912, and 43 per cent. had borne that crop in 1911; none of the injured fields was under oats, rye or barley in 1912, but 52 per cent.

bore those crops in 1911. Of the nineteen uninjured fields 14 were under maize in 1912 and the same in 1911, three under grass in both years, one wheat in both years, one rye in 1912 and one oats in 1911.

Forbes (S. A.). **The Chinch-bug Outbreak of 1910-1915.**—*Twenty-ninth Report of the State Entomologist of the State of Illinois, Urbana, 1916*, pp. 71–127, 6 maps, 7 figs.

The outbreak of *Blissus leucopterus*, which began in the autumn of 1909 and continued growing in intensity and gradually widening area until the spring of 1915, when it suddenly collapsed, caused a diminution in the yield of maize, wheat and oats amounting to a total value of £1,288, 597. These losses were computed upon a comparison of crop yields and conditions in 17 counties of Illinois; though if the losses for six more counties for the same period be added, the lowest reasonable estimate of the total immediate loss in the three staple crops amounted to £2,600,000. An analysis of the weather conditions for a period of years previous to the outbreak points to a conclusion that the immediate cause was unusually hot midsummer weather, with no excessive rainfall, occurring in a region in which the food-plants, especially winter wheat, occupied a relatively large area. The outbreak appears to have been in the nature of an overflow from the heavily infested territory, the direction of which was governed in part by the nature of the crops, but in great measure also by the direction of the prevailing winds at times when the insects were on the wing, especially in spring when emerging from hibernation, and in the autumn when in search of winter quarters. The outbreak was brought to a conclusion in the spring and early summer of 1915 by heavy rains at a time when the young bugs were hatching.

B. leucopterus is attacked by some twenty species of predaceous insects, mostly Coccinellids, ground beetles, Rhynchota, and larvae of lacewing flies, as well as the ants, *Formica fusca subsericea* and *Lasius niger americanus.* It is parasitised in the egg stage by *Eumicrosoma benefica,* Gahan [see this *Review*, Ser. A, ii, p. 383].

The artificial methods of control recommended are the burning out of the insects in their winter quarters and their destruction at harvest time by means of impassable barriers and lines of post-hole traps placed beside infested fields of wheat. Comparing the results of experiments with substances suitable for these barriers, it was found that to be effective, ordinary road-oils had to be applied 41 times in 10 days, road-oil No. 6 ten times and road-oil No. 7 only four times. The latter was used in the operations of 1912, but the accidental discovery of the efficacy of crude creosote as a repellent, led to its use in 1913. It was not quite as effective as the road-oil, but sufficiently so to be of great value.

Experiments are described with kerosene emulsion and Black Leaf 40; soap solutions alone, three ounces to the U.S. gallon of water, proved almost as effective.

The results of the campaign of 1914 showed that the cost of material and labour used in maintaining 15,000 miles of barrier amounted to £8,100, but this protected an area of 190,590 acres yielding 4,764,750 bushels of maize, a fourth of the yield of which, worth £143,000, was due to these protective measures.

As the individual farmer will not incur the trouble and expense of destroying this pest, unless he knows that the other members of the community will do the same, it is proposed to introduce legislative measures similar to those in force for the control of the San José scale [*Aspidotus perniciosus*] and other pests of horticulture, subject to the proviso that they shall take effect only when and where a proclamation by the Governor of the State may direct.

Preserving Corn.—*Jl. Jamaica Agric. Soc., Kingston*, xx, no. 10, October 1916, pp. 407–408. [Received 1st December 1916.]

Various preventives of the infestation of maize by weevils are suggested. For small quantities in barrels or boxes, small porous bags of naphthaline at the rate of two tablespoonfuls to a barrel may be placed at the bottom of each. Naphthaline used in this way is a preventive only and will not be effective when maize is badly infested. For large quantities of grain, carbon bisulphide may be placed in small tins at the top of the grain, using 1 oz. for every 50 cubic feet.

Strauss (T. F.). **The Grape Leaf-folder.**—*U.S. Dept. Agric, Washington, D.C.*, Farmers' Bulletin no. 419, November 9th 1916, 16 pp., 4 plates, 6 figs.

The Pyralid, *Desmia funeralis*, which has long been known as a grape-vine pest, has been the subject of two seasons' observations in the vicinity of Washington. A detailed history of this insect is given from literature going back as far as 1796. Its distribution practically covers all regions where wild and cultivated grapes grow in the United States and extends north over a considerable portion of Canada. It has been found on *Vitis labrusca*, *V. rotundifolia* and *V. cordifolia*. All varieties of cultivated grapes are liable to attack, those with tough leaves being generally less attractive than varieties with more tender foliage. *D. funeralis* also feeds on Virginia creeper and two varieties of redbud, *Cercis canadensis* and *C. chinensis*. In the author's experience the foliage only of the grape-vine is attacked, though the larvae of the first brood have been recorded as eating the blossoms and young fruit. The effect of the attack is to fold over and skeletonise the leaves, which dry up and expose the fruit to the rays of the sun, rendering it unmarketable in severe attacks. The various stages are described. The moths are on the wing from the end of April to June and mostly emerge early in May. The proportion of females to males is about seven to one. The eggs are usually deposited singly on the underside of the leaf, and hatch in 8 to 10 days. The young larva does not begin to fold the leaves until about two weeks old. In the latitude of Washington, and perhaps in most of the Northern States, there are two generations a year. In the Southern States it is thought that there may be three or more. The majority of first-brood larvae pupate during July, the average duration of the larval stage being about four weeks. The full-grown larvae leave their shelters and drop to the ground, where they transform among fallen leaves, etc. During late July and August the moths are again on the wing and depositing eggs, giving rise to the larvae of the second brood, which is far more numerous than the first. These pupate in September in Washington, and by mid-October few, if any, are to be found in the leaves. The pupae of this brood pass the winter among dead leaves on the ground.

The parasites of *D. funeralis*, reared by the author, include:—Hymenoptera: *Apanteles canarsiae*, Ashm.; *Habrobracon johannseni*, Vier.; *Meteorus dimidiatus*, Cress.; *Pardianlomella ibseni*, Gir.; *Trichistus pygmaeus*, Cress.; *Mesochorus scitulus*, Cress.; *Gemocerus* sp. Diptera: *Tachinophyto variabilis*, Coq.; *Exorista pyste*, Walk.; *Leskiomima tenera*, Wied. Notes were made on the life-histories of several of these parasites. *A. canarsiae* is numerous during late August and early September and feeds externally, the pupal stage lasting about five days. *M. dimidiatus* was fairly abundant in one locality in Virginia and attacks the larva of *D. funeralis* in early autumn. This species is itself parasitised by *Perilampus platygaster*, Say, in both the larval and pupal stages. On 27th September several eggs of a new Eulophid, *Pardianlomella ibseni*, were found on a larva of this moth. The eggs hatched the following day, and in five days the parasites had left the remains of their host and pupated. These pupae were kept in jars during the winter and in spring the adults emerged. *Habrobracon johannseni*, Vier., a new Braconid, was found to be widely distributed; it feeds externally on the larvae of *D. funeralis*.

Arsenical sprays are efficacious as a control, and vineyards regularly sprayed are generally free from this pest. Where the insect has been troublesome in previous years, the vines should be well sprayed shortly after the blossoms have fallen with arsenate of lead at the rate of 2 lb. of the paste or 1 lb. of powdered arsenate to 50 U.S. gallons of water. One such treatment should destroy the caterpillars of the first brood so effectually that injury by the second brood would be of little importance. Where it is impracticable to spray the vines, it is decidedly advantageous to go thoroughly over the plants and crush the folded leaves by hand. Foliage falling in the autumn should be raked together and burnt.

A bibliography of 26 works is given.

Williams (C. B.). **Biological and Systematic Notes on British Thysanoptera.**—*Entomologist, London,* xlix, nos. 641, 642, 643, pp. 221–227, 243–245, 275–284, 1 fig.

Four British species of Thysanoptera, three of them new to the British fauna, are described in these articles. The life-histories of several others, some of which are of economic importance, are also given. *Sericothrips gracilicornis*, sp. n., is described from mixed herbage and bedstraw (*Galium*), and *Heliothrips errans*, sp. n., from three females found on orchids (*Laelia anceps*) in a greenhouse. The original home of this latter species is doubtful, but these individuals were probably imported from Central America. *H. brunneipennis*, to which it is most closely allied, is only known from Ceylon. The author now accepts the name, *Kakothrips pisivora*, Westw., which was described from the larva, as having priority over *K. robustus*, Uzel [see this *Review*, Ser. A, iii, p. 279]. Observation in 1915 showed a great increase of this pest As regards its natural enemies, several specimens of a Chalcid (*Pirene scylas*, Walk.) have been found to be closely associated with this thrips, though it was not definitely proved to be a parasite of it. A mite, *Actineda vitis*, Schr., was found sucking a larva of the pea-thrips, and larvae of the predaceous thrips, *Aeolothrips fasciatus*, were fed on those of *K. pisivora* in captivity, and this probably also occurs in nature.

The food-plants of *K. pisivora* are *Echium vulgare, Orchis, Rosa centifolia*, and yellow melilot (*Melilotus officinalis*), also *Pisum saccharatum* in Galicia. *Odontothrips loti*, Hal., is considered distinct from *O. ulicis*, of which it has been considered a synonym. The process of oviposition by *Taeniothrips primulae*, Hal., on primroses is described. It has been found on flowers of woodsage (*Teucrium scorodonia*), primrose (*Primula vulgaris*) and cowslip (*Primula veris*), and hibernating in moss. Larvae bred from primroses in the spring probably reach the adult stage and produce a second generation on other flowers in the same year.

Examples of *Taeniothrips inconsequens*, Uzel, have been compared with *T. pyri*, Dan., and have been found to differ only in unimportant details and must be treated as synonomous, the former name having priority. Both European and American examples feed on *Prunus cerasus*, but are not usually injurious in the former country. This thrips is believed to have been imported into America from Europe for the following reasons. Only females are found in America, reproduction being entirely parthenogenetic, whereas both sexes occur in Europe. Its rapid spread since it was first noticed in America suggests the absence of natural enemies. The ease by which introduction may be effected in the soil clinging to the roots of fruit stock adds to the probability of this, as the insect spends 10 months of the year in the soil in the larval and pupal stages without feeding. Only ripe fruit, free from this thrips, is sent in the reverse direction. It also has no near allies in America, whereas *T. primulae*, a closely allied species, occurs in Europe. *T. inconsequens* occurs in England, Bohemia, the United States and Canada. It may be found on laurel flowers (*Prunus lauro-cerasus*), flowers of fruit trees, the young leaves of horse chestnuts (*Aesculus hippocastanum*) and sycamore (*Acer platanoides*), *Prunus cerasus*, *Anemone nemorosa* and *Populus tremula*.

Thrips nigra, sp. n., from the underside of leaves of elder (*Sambucus nigra*) is described. *Thrips* (*Bagnallia*) *calcarata*, Uzel, on young leaves of lime (*Tilia vulgaris*), *T. nigropolosus*, Uzel, on wheat, and *Bolacothrips jordani*, Uzel, are recorded for the first time in Britain. *Haplothrips flavitibia*, sp. n., is described from specimens on hawthorn (*Crataegus oxyacantha*).

RITCHIE (W.). **Some Forest Insects in Aberdeenshire.**—*Scottish Naturalist, Edinburgh*, no. 60, December 1916, pp. 301–302.

The large larch sawfly, *Lygaeonematus* (*Nematus*) *erichsoni*, is recorded for the first time in Aberdeenshire. Owing to the damage it does in England, this insect is included among those scheduled under the Destructive Insects and Pests Order, and its presence must be reported to the Board of Agriculture. *Attelabus nitens*, Scop. (*curculionoides*, L.), *Cryptorrhynchus lapathi*, L., on willow, and *Cryphalus abietis*, Ratz., on silver fir, are also recorded.

TREHERNE (R. C.). **A Review of the Codling-Moth Situation in British Columbia.**—*Agric. Jl., Victoria, B.C.*, i, no. 7, September 1916, p. 109, 1 fig. [Received 6th December 1916.]

Attention is drawn to the fact that the importance of *Cydia pomonella* in British Columbia is yearly becoming more pronounced. At present

small numbers are to be found in Victoria, Okanagan Landing, Westbank and Kaleden, while at Vancouver and Kelowna it would probably be found on careful search. During the past six years, fruit crops have greatly increased and varying and increasing numbers of codling moth outbreaks have occurred. As a whole, however, the main fruit areas are not yet affected.

DAVIS (M. B.). **A Test of different Arsenates of Lead.**—*Rept. Div. Hortic. for the Year ending March 31, 1915, Dept. Agric. Ottawa,* pp. 616–617. [Received 5th December 1916.]

Twelve brands of commercial arsenate of lead, both in the powdered and in the dry form, were tested as to adhesive qualities and injurious effect upon foliage. They were also tested by the Chemical Division, with the result that from the two sets of data it is shown that one preparation costing considerably more than another is often the cheaper on account of its greater percentage of arsenic. The percentage of soluble arsenic was never as great as 1 per cent. and no scorching of foliage resulted, though the insecticide was applied at the rate of 10 lb. to 40 gals. of water. The powdered form appeared to mix better with water than the paste and had a higher adhesive value, owing to the particles being more finely divided.

Purchasers of commercial arsenates of lead should ascertain from the retailer or manufacturer the percentage of arsenic oxide and purchase on the unit basis. Assuming that a certain paste contains 14·35 per cent. of arsenic oxide and a dry preparation 32·18 per cent. of the oxide, and that the latter costs £4 per 100 lb. and the former £2 15*s.*, in the case of the dry preparation the cost is about 2*s.* 6*d.* for each per cent. of oxide as compared with 3*s.* in the case of the paste. There is also a saving in carriage.

GIBSON (A.). **The Control of Ants in Dwellings.**—*Canadian Entomologist, London, Ont.*, xlviii, no. 11, November 1916, pp. 365–366.

The common carpenter ant, *Camponotus pennsylvanicus*, was found to be controlled by dusting sodium fluoride powder into the openings between the beams and roof and other cracks or openings by means of a puffer or dust gun in the evening. The same experiment was tried in another locality against the common shed-builder ant, *Cremastogaster lineolata*, with equal success. In every case one application of the powder was found sufficient.

ROSS (W. A.). **The Susceptibility of the Eggs of** *Aphis pomi* **and** *Aphis avenae* **to Hydrocyanic Acid Gas.**—*Canadian Entomologist, London, Ont.*, xlviii, no. 11, November 1916, p. 367.

It is noted that the fumigation of young apple trees with hydrocyanic acid gas just before or shortly after the buds commence to swell not only controls the San José scale [*Aspidiotus perniciosus*], but also destroys the eggs of Aphids. Of seven trees well stocked with the eggs of *Aphis pomi* and *Aphis avenae*, three were fumigated with hydrocyanic acid gas (1 oz. KCN to 100 cubic feet, 1 : 13 formula) for forty-five minutes. None of the eggs on the fumigated stock hatched, whereas large numbers did so on the control trees.

Gibson (A.). **A new species of** *Tortrix* **of Economic Importance, from Newfoundland (Lepidoptera : Tortricidae).**—*Canadian Entomologist, London, Ont.*, xlviii, no. 11, November 1916, pp. 373–375, 1 plate.

Tortrix oleraceana, sp. n., the larvae of which were present in destructive numbers on some farms near St. John's, is described. It was at first thought that it might be the European species, *T. wahlbomiana* var. *vigaureana*, Tr., and that it had been imported with spring cabbage plants from Ireland. Examples sent to the Imperial Bureau of Entomology were however found not to agree exactly with any of the British forms of this variable species.*

Cameron (A. E.) & Treherne (R. C.). **The Pear Thrips in British Columbia and its Control.**—*Agric. Gaz. Canada, Ottawa*, iii, no. 11, November 1916, pp. 946–951, 4 figs.

The pear thrips, *Taeniothrips pyri*, Dan., now shown to be identical with the European species, *T. inconsequens*, Uzel [see this *Review*, Ser. A, v, p. 68], has been the object of investigations as to its destructiveness and its control under Canadian conditions. The principal damage to deciduous fruit trees is effected by the feeding of the adults on the buds. Where a number of individuals attack the same bud, it acquires a shrivelled appearance and is then peculiarly liable to attack by blue moulds. The damage throughout a pear orchard is by no means uniform. Apples appear to suffer less from the effects of attack by the adult than pears, though the damage done to Italian prunes and different varieties of plums is far heavier. Cherries may suffer badly, but efficient spraying will control the insects in the bud clusters. An extensive campaign of spraying with a mixture of whale-oil soap, 5 lb., and Black Leaf 40 (nicotine sulphate) $\frac{3}{4}$ pint to 100 gals. of water, was carried out at various points on Vancouver Island with satisfactory results. Three applications were made on apples and pears, just as the buds were bursting, when the blossoms were showing pink, and when they were shed. For the last two sprayings, arsenate of lead at the rate of 4 lb. to 100 gals. was added to the mixture to combat leaf-eating caterpillars. Only two applications were made on prunes, plums and cherries, one before blossoming and one after. Another mixture consisting of miscible oil, No. 2, 5 gals., and Black Leaf 40, 1 pint to 200 gals. of water, was tried, but this caused scorching of the leaves, and the oil persists on the branches and trunks and tends to neutralise the full effects of the autumn application of Bordeaux mixture for combating apple and pear scab. A table is given showing the number of thrips larvae on the trees before and after spraying and the percentage of mortality.

At present *T. inconsequens* has been taken only on the Saanich peninsula and at Duncan, but has not been noted on the mainland of the province.

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* Mr. J. H. Durrant informs us that some of the varieties figured in this paper agree well with British examples, and he cannot regard them as being specifically distinct.—Ed.

Bees and Pollination.—*The Planters' Chronicle, Bangalore,* xi, no. 46, 11th November 1916, p. 572.

Bees play a very important part in the fertilisation of coconuts in Fiji, and those palms that are freely visited by bees when in flower, give a high yield of nuts. The general introduction of bees into coconut plantations in Fiji is therefore considered well worth a trial. The same phenomenon has been noticed in connection with the sago or wine palm, *Caryota urens.*

A Weevil attacking Vegetables.—*Agric. Gaz., N.S.W., Sydney,* xxvii, no. 10, October 1916. p. 706. [Received 11th December 1916.]

Specimens of larvae and pupae of a weevil attacking vegetables and weeds in the Richmond district have been identified as the grey-banded leaf weevil, *Ethemaia sellata.* The use of a poison bait containing Paris green is recommended against the larvae.

Clifton (E.). **Control of the Black Cricket. Californian Methods with Grasshoppers.**—*Jl. Agric., Wellington, N.Z.,* xii, no. 3, 20th March 1916, pp. 187–189. [Received 13th December 1916.]

The black cricket, *Gryllus servillei,* does considerable damage in some of the northern districts of New Zealand during the summer, especially on rich, fertile swamps in the process of reclamation and in hilly country where, during dry hot weather, openings in the soil provide it with shelter.

Thorough cultivation with draining of the swamps and poisoning of the adult by means of a mixture of 25 lb. of bran, 1 lb. arsenic and 2 quarts molasses, in 4 gallons of water, are recommended.

Campbell (J. O.). **The Orchard.**—*Jl. Agric., Wellington, N.Z.,* xiii, no. 4, 20th October 1916, pp. 318–321. [Received 11th December 1916.]

The month of November marks the opening of summer work in orchards in New Zealand. The codling moth [*Cydia pomonella*] is seldom active before the end of the second week of November. Spraying with arsenate of lead at the rate of $1\frac{1}{2}$ lb. to 2 lb. (paste) or 1 lb. to $1\frac{1}{4}$ lb. (powder) to 50 gals. of water must be done before the calyx closes, the object being to effect the retention of a small amount of poison within the eye of the apple and thus prevent the entry of the larva at this point later in the season. The period between sprayings should not be more than three to four weeks. Leaf-roller caterpillars may be controlled by the same spray, care being taken to cover the foliage as well as the fruit. For black spot, 3–4–40 Bordeaux mixture may be used; a weak solution of Bordeaux mixture or lime-sulphur, 1–100 to 1–125, for brown-rot; and lime-sulphur, 1–80 to 1–100, combined with arsenate of lead, for mussel scale [*Lepidosaphes*] and red mite [*Tetranychus*].

Fullaway (D. T.). **Report of the Division of Entomology.**—*Hawaiian Forester and Agriculturist, Honolulu,* xiii, no. 9, September 1916, pp. 339–341. [Received 5th December 1916.]

During the month of August, a total of 1,255 females and 623 males of *Opius fletcheri* and 1,700 *Tetrastichus* were liberated.

The corn leaf-hopper egg-parasite introduced by Mr. Osborn in July was very successfully multiplied during the month.

Fullaway (D. T.). **Report of the Division of Entomology.**—*Hawaiian Forester and Agriculturist, Honolulu*, xiii, no. 10, October 1916, p. 370. [Received 13th December 1916.]

During the month of October, the following parasites were reared and liberated: *Opius fletcheri* (the new melon fly parasite), 2,210 females and 1,329 males; 1,000 *Tetrastichus*; 200 Chalcids (*Dirhinus*) and 126 corn leaf-hopper egg-parasites.

Ehrhorn (E. M.). **Report of the Division of Plant Inspection.**—*Hawaiian Forester and Agriculturist, Honolulu*, xiii, no. 9, September 1916, pp. 341–343. [Received 5th December 1916.]

During the month of August, tree seeds from Manila were fumigated for weevil infestation and various plants infested with scale-insects were treated with hydrocyanic acid. At Hilo, turnips infested with the turnip fly were intercepted and ten bags of rice from Japan were found to be attacked by the rice moth, *Paralipsa modesta*, and were fumigated before delivery.

Ehrhorn (E. M.). **Report of the Division of Plant Inspection.**—*Hawaiian Forester and Agriculturist, Honolulu*, xiii, no. 10, October 1916, pp. 366–369. [Received 13th December 1916.]

The following pests have been intercepted on plants from Java and the Philippines:—*Aspidiotus cyanophylli*, on palms; *Saissetia nigra*, on an agave; some Chrysomelid beetles; a few *Anomala* larvae; two species of ants (*Prenolepis bourbonica* and *Monomorium pharaonis*); a few millipedes (*Julus* sp.) and a centipede (*Scolopendra* sp.); *Iridomyrmex humilis* (the Argentine ant) was found on miscellaneous plants from the Pacific Coast; and a consignment of pears was found to be badly infested with the codling moth [*Cydia pomonella*].

Dean (G. A.). **Insects Injurious to Alfalfa.**—*Kansas State Agric. Coll., Div. of Coll. Exten., Manhattan*, Bull. no. 5, January 1916, 36 pp., 39 figs. [Received 4th December 1916.]

This bulletin deals with the distribution, life-history and methods of control of various lucerne pests. These include:—The clover-root borer, *Hylastinus obscurus*, Marsh.; clover-root curculio, *Sitones hispidulus*, F.; *S. flavescens*, All.; and *Lachnosterna negosa*. The larvae of beetles of the genus *Lachnosterna* are preyed upon by birds, skunks and moles, and a small percentage are destroyed by a parasitic fungus and sometimes a large number by parasitic insects, of which the chief is *Tiphia inornata*, Say. *Melanoplus differentialis*, Thos. (differential grasshopper), *M. bivittatus*, Say (two-striped, grasshopper), and *M. atlantis*, Riley (migratory grasshopper), may occur in sufficient numbers to do serious harm to lucerne. Their natural enemies include upwards of one hundred species of birds. They are often infested by mites and are parasitised by several flies, including *Sarcophaga georgina*. The army worm, *Cirphis* (*Leucania*) *unipuncta*, Haw., is seldom seriously abundant in the same neighbourhood for two years running, as it is kept well under control by parasitic and predaceous enemies. Of the former, a Tachinid fly, *Winthemia quadripustulata*, is the most

important. The fall army worm, *Laphygma frugiperda*, S. & A., variegated cutworm, *Lycophotia margaritosa*, Haw. (*Peridroma saucia*, Hb.), and garden webworm, *Phlyctaenodes* (*Loxostege*) *similalis*, Gn., can be controlled by the usual methods. The alfalfa caterpillar, *Colias* (*Eurymus*) *eurytheme*, Boisd., is sufficiently controlled by natural enemies to prevent it from becoming a serious pest. Other pests dealt with are the alfalfa weevil (*Hypera* (*Phytonomus*) *murina*), F., the clover leaf weevil (*H.* (*P.*) *punctata*, F.), the mound building prairie ant (*Pogonomyrmex occidentalis*, Cress.), MELOIDAE, JASSIDAE, the clover-seed Chalcid (*Bruchophagus funebris*, How.), and the clover hayworm (*Hypsopygia costalis*, F.).

FLETCHER (W. F.). **The Native Persimmon.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 685, 12th October 1915, 25 pp., 17 figs. [Received 13th December 1916.]

The most important insect enemy of persimmon is the hickory twig girdler, *Oncideres cingulata*, Say. It makes its appearance about the middle of August and may be found till the beginning of October. The injury caused by this insect occurs in the process of oviposition, the adult gnawing a small hole in the bark, usually just above or below a bud, into which the egg is inserted. Several eggs are usually deposited in a twig in this manner, and the insect then begins girdling the twig beneath the point of oviposition. This ringing of the twig weakens it to such an extent that it is broken off by the wind during the winter or the following spring. To control it, the twigs should be collected in June or early July and burnt.

MILLIKEN (F. B.). **The Cottonwood Borer.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 424, 9th November 1916, 7 pp., 1 plate, 3 figs.

This is a record of investigations made during 1913–15 in Kansas. A description of the various stages of this Longicorn (*Plectrodera scalator*, F.) is given. The female deposits her eggs in a cavity which she has bored through the bark into the wood of young cottonwoods (*Populus deltoides*) or willows (*Salix alba*) at or a little below the surface of the ground. Oviposition begins in July and probably extends into September. The eggs hatch in about two weeks and the young larva bores a tunnel in the tender bark just outside the wood. In the following spring the larvae average from $1\frac{1}{2}$ to 2 in. long, and during the second winter they occupy large tunnels reaching from the inside of the bark near the ground-level to several inches below it. Pupation takes place about the beginning of July, the pupa resting at the lower end of the tunnel. The adults emerge from about mid-June until the 1st of August. Several young larvae were found dead and covered with a fungus, but no instance of parasitism was observed during the investigations. The trees examined showed an average of eight eggs and small larvae to each tree, this number being sufficient to do serious damage. As a preventive, the trunks should be screened with a cone-shaped piece of galvanised netting of $\frac{1}{4}$ to $\frac{1}{2}$ in. mesh fitting closely or bound to the tree at the top and extended at the base

an inch or two from the trunk to prevent oviposition through it. Tunnels that were too deep to allow of the removal of larvae were injected with carbon bisulphide, but this is of little advantage as the larger larvae in the deep tunnels have already done nearly all the injury of which they are capable.

SPAULDING (P.) & HARTLEY (C.). **Safety First in Tree Planting.**—*American Forestry, Washington, D.C.*, xxii, no. 275, November 1916, pp. 664–668, 8 figs.

An appeal is made to American tree planters to do all that is possible to avoid the importation of any new pests into the country. Great damage has already been caused by many imported varieties of fungi and insect pests. The gipsy and brown-tail moths [*Lymantria dispar* and *Euproctis chrysorrhoea*], imported from Europe, are now established in New England, where they cause tremendous havoc, and millions of pounds have been spent in attempting their extermination. Restriction of migration and the encouragement of natural parasites are the only measures now taken to check extension of the damage. The pitch-pine bud moth [*Rhyacionia buoliana*] has recently been discovered in imported material and is very difficult to exterminate. Inspection before transport has proved only a partial safeguard, for the most dangerous species may not have been serious pests in their native habitats, though they may become so in a fresh climate and on a new host. Moreover, some infested trees exhibit no signs of infestation at the time of inspection. The measures suggested for adoption by plant growers include the avoidance of importation of nursery stock from any other Continent, and keeping distinct the three natural divisions of the United States forest, i.e., the East, the Rocky Mountain and the Pacific Coast, each of which contains some trees and their enemies not present in any other division. If it is absolutely necessary to buy from a nursery in another region, the planter should choose one in a farming community and in open rather than in forested country, where the stock is raised from seed.

HAWLEY (R. C.) & RECORD (S. J.). **Do Ants kill Trees about their Colonies?**—*American Forestry, Washington, D.C.*, xxii, no. 275, November 1916, pp. 685–686, 4 figs.

Observations have been made on many ant-hills in various parts of Connecticut and Pennsylvania to determine whether ants are responsible for the death of trees growing near their colonies. These colonies were, in all cases but one, those of the red ant, *Formica exsectoides*, Forel. The damage was chiefly done to white pine, though other varieties were affected, such as Scotch pine, red cedar, American aspen, and others. The area of infestation is, roughly, a radius of 10 feet from each ant-hill and as many as 40 trees have been found killed around a single colony. The first sign of injury exhibited by the white pine is a yellowing of the leaves, which increases till the tree dies and the leaves turn brown. Examination of the dead trees shows a constriction of the trunk extending a few inches above the ground-level, with a decided swelling at the upper margin. It is believed that the damage is caused by *Formica exsectoides*, probably in order that the trees shall not shade

their colonies too much, though the immediate cause of the death of the trees is not yet understood. It was believed to be due to a fungus, but inoculation of healthy trees has produced negative results. If fungi or bacteria are responsible, the only possible means of dissemination is through the agency of the ants. There is no evidence that the damage spreads from tree to tree, while their appearance shows that death is not due to mechanical injury to the bark. The only means of control is to destroy the ant colonies, and experiments are being made to determine the best method of destruction. Carbon bisulphide and naphthaline may prove efficacious if properly administered. Extermination should be done prior to planting.

QUAINTANCE (A. L.) & WOOD (W. B.). *Laspeyresia molesta*, **an important new Insect Enemy of the Peach.**—*Jl. Agric. Research, Washington, D.C.*, vii, no. 8, 20th November 1916, pp. 373–377, 6 pl.

Cydia (*Laspeyresia*) *molesta*, sp. n., is recorded from the District of Columbia, where it seems to have been established for some five years or more. It is very prevalent on peach trees in the city of Washington and adjacent towns in Virginia and Maryland. Though it is closely allied to *C. funebrana*, Tr., and to several American species, it is considered probable that it is a native of Japan. Both the adult and larval stages of this moth are described. The caterpillars have been found injuring the twigs of peach, plum and cherry and the peach fruit; in the case of peach twigs as many as 90 per cent. have been found injured in one orchard, while the injury in peach nurseries is even more serious. Attacks on the twigs begin in the spring and continue until active growth ceases in autumn. As the twig hardens, the larva may leave its burrow and feed on the exterior, cutting holes and pits in the bark. On tender, growing shoots, which the larvae prefer, the injury is almost identical with that of the peach-twig borer, *Anarsia lineatella*, Zell. Several shoots may be injured in turn by one larva and the fruit is attacked at all stages, though the infestation is worst in mid-season and early autumn. Pupation occurs in the spring and the cocoon of whitish silk may be found in almost any protected place on the tree or fruit where the larva hibernates. Owing to this habit of hibernating as a larva, its detection on nursery stock and young trees is extremely difficult, and the disinfection of trees can only be insured by adequate fumigation with hydrocyanic acid gas, or other suitable substance. Oviposition takes place in the spring, when the shoots of the peach are well out, and there are apparently two and probably three broods each year, as injury begins in spring and larvae in various stages of growth are to be found in late autumn.

HYSLOP (J. A.). *Pristocera armifera*, **Say, parasitic on** *Limonius agonus*, **Say.**—*Proc. Entom. Soc., Washington, D.C.*, xviii, no. 3, September 1916, pp. 169–170, 1 plate. [Received 13th December 1916.]

While investigating a serious infestation of maize by the Elaterid, *Limonius agonus*, in Vermont, a larva was found with a Hymenopterous larva firmly attached to its ventral surface. This was bred out and

identified as the Bethylid, *Pristocera armifera*, Say. During its larval existence it attacked and destroyed a second host. Pupation took place in a silky cocoon and this stage lasted thirty-three days.

Barber (H. S.). **A new Species of Weevil injuring Orchids.**—*Proc. Entom. Soc., Washington, D.C.*, xviii, no. 3, September 1916, pp. 177–179, 1 plate. [Received 13th December 1916.]

Cholus cattleyarum, sp. n., found on *Cattleya mossiae*, is described. It has done considerable damage to these orchids in a greenhouse in Milwaukee and probably came from Colombia or northern Brazil.

[This insect has been previously described under the name of *Cholus cattleyae*, Chmp.—Ed.]

Cushman (R. A.). **The Native Food-plants of the Apple Red-bugs.**—*Proc. Entom. Soc., Washington, D.C.*, xviii, no. 3, September 1916, p. 196. [Received 13th December 1916.]

From observations made in 1915 with regard to the occurrence of *Heterocordylus malinus*, Reut., and *Lygidea mendax*, Reut., on apple, crab apple and *Crataegus*, the former was found to be fairly abundant, occasional or absent on apple and wild crab and very abundant on *Crataegus*, while the latter was very abundant in two cases on apple and wild crab, but very rare on *Crataegus*. This points to the apple being the chief food-plant of *L. mendax* and to *Crataegus* being that of *H. malinus*.

Crosby (C. R.) & Leonard (M. D.). **The Tarnished Plant-bug,** *Lygus pratensis*, **L.**—*Cornell Univ. Agric. Expt. Sta., Ithaca, N.Y.*, Bull. 346, June 1914, pp. 463–525, 27 figs. [Received 14th December 1916.]

In this full and complete account of *Lygus pratensis*, L., a list is given of about fifty plants of economic value that are attacked by it. It has also been proved to be capable of transmitting fire-blight.

A detailed account of the life-history is given. The natural enemies of the bug include a minute Mymarid parasite, *Anagrus ovijentatus*, Cr. & Leon., which is described, and some birds. The injury done to peach stock is described and illustrations of other plants injured by it are given.

Numerous methods of control are discussed. Its control on peach nursery stock presents peculiar difficulties, as the injury is done in a a few days by the active, winged adults that invade the peach orchards in countless swarms from surrounding meadows. As they take flight at the slightest alarm, they are practically impossible to reach with a spray, besides which their integument is highly resistant to the strongest contact insecticides that it is possible to use on peach foliage.

A series of experiments with soap, nicotine, kerosene emulsion, and asafoetida are described, none of which appears to be effective; also of dusting experiments, the use of sticky shields, suction apparatus and

molasses, all of which were eventually discarded as useless. It is finally suggested that further experimental work should be carried out in connection with the use of fencing, bagging (especially with mosquito-nets), pruning and cultural practices.

A bibliography of 266 references is appended.

Knight (H. H.). **The Army-worm in New York in 1914.** *Leucania unipuncta*, **Haworth.**—*Cornell Univ. Agric. Expt. Sta., Ithaca, N. Y.*, Bull. 376, May 1916, pp. 751–765, 8 plates. [Received 14th December 1916.]

Cirphis (*Leucania*) *unipuncta* caused considerable damage to pasture lands and hay and grain crops in several parts of New York State in 1914. Damage was also reported from other States, while eastern Canada suffered very severely [see this *Review*, Ser. A, iii, p. 18], the total loss of crops being estimated at £50,000 for Ontario alone. In 1915 the moth was far less abundant.

The army worm seems to prefer certain wild grasses, such as *Agrostis alba*, to all others, bluegrass, timothy, and orchard grass being also eaten when they come in the path of the migrating caterpillars. Of cultivated crops oats and maize are first attacked, then barley. Certain leguminous crops, such as clover and lucerne, are apparently immune, as also are beans and peas.

C. unipuncta is parasitised by the red-tailed tachina fly, *Winthemia quadripustulata*, F., the yellow-tailed tachina fly, *Goniomima unifasciata*, R.D., the Braconids, *Meteorus communis*, Cress., *Apanteles militaris*, Walsh, and *A. rufocoxalis*, Riley, and the Ichneumonid, *Ichneumon laetus*, Brull. It is preyed upon by a large bug, *Apateticus cynicus*, Say, and a Carabid, *Calosoma calidum*, F., in the larval stage. Other Carabids, such as *Pterostichus lucublandus*, Say, *P. mutus*, Say, *Harpalus caliginosus*, F., and *H. pennsylvanicus*, Dej., attack both larvae and pupae. Of birds, the most effective are crows, cowbirds, grackles, meadow larks and robins. Poultry will also devour them with avidity.

Artificial methods of control that may be employed are the formation of barriers, the digging of furrows or deep trenches, and the laying of dust mulches with lines of tar or similar substances. A poison bait composed of 100 lb. wheat bran, 3 lb. Paris green, $7\frac{1}{2}$ U.S. gals. stock molasses, 7 U.S. gals. water, and 1 doz. chopped oranges, was used effectively in oat fields in Kansas.

Herrick (G. W.) & Hadley, Jr. (C. H.). **The Lesser Migratory Locust** (*Melanoplus atlantis*, **Riley.**).—*Cornell Univ. Agric. Expt. Sta., Ithaca, N. Y.*, Bull. no. 378, 45 pp. 6 pls., 17 figs.

Melanoplus atlantis, Riley, is indigenous to the North American continent, where it is very widely distributed. A full description of its life-history is here given. Rye, oats and maize are all severely attacked, as well as almost all other crops. Its natural enemies include birds, predatory and parasitic insects. Poultry are useful in destroying it. The most practicable method of control is ploughing of the breeding places of the insects in spring and autumn to a depth of six inches or more; disking and harrowing are also

helpful. "Criddle mixture" and other baits of which particulars have already been given [see this *Review*, Ser. A, iii, p. 298] are recommended. When practicable, the hopper-dozer may be used, as well as sprays containing arsenate of lead, Paris green, or sodium arsenite.

A bibliography of 34 works is given.

HATANO (T.). **On the Value of Lime in Relation to Silkworm Nutrition.**—*Internat. Rev. Science and Practice Agric., Mthly. Bull. Agric. Intell. and Pl. Dis., Rome,* vii, no. 8, August 1916, pp. 1147–1148. [Abstract from *Bull. de l'Assoc. Séricole du Japon,* ii, no. 4, 1st March 1916, pp. 1–4.] [Received 13th December 1916.]

Experiments were made with 500 worms having but one generation a year, at the time of the fifth moult, to test the nutritive effect of various calcium salts. They were divided into four groups, and were fed on leaves treated with 5 per cent. solutions of calcium bicarbonate, calcium chloride, calcium acetate, and untreated leaves respectively.

The weights are given of 100 examples of each stage from each group, and it was found that the figures are higher in every case in the first three groups than in the control, an increase in the weight of the yield of silk being obtained as well as increase in size of the worms.

Further experiments will be undertaken to ascertain which calcium salt yields the best result and what degree of concentration is advisable.

Study of Sericulture in Madagascar.—*Internat. Rev. Science and Practice Agric., Mthly. Bull. Agric. Intell. and Pl. Dis., Rome,* vii, no. 8, August 1916, pp. 1148–1149. [Abstract from *Bull. Economique de la Colonie de Madagascar et Dépendances, Antananarivo,* xv, no. 1, 1915, pp. 1–17.] [Received 13th December 1916.]

Before the French occupation of Madagascar, the silk used by the natives was obtained exclusively from the Lasiocampid, *Borocera madagascariensis*, which occurs very widely in the central and western parts of the island and feeds on a considerable number of plants. It sometimes becomes a positive pest in the mimosa plantations and is still regularly reared on *Upaca clusiacea*, which occurs in more or less dense forests on the lateritic hills. In the regions of Majunga and Maintirano, *B. madagascariensis* lives wild in the *Rhizophora* forests of the coast, and the natives gather the cocoons at certain periods of the year. There are other native silk-bearing species, such as the Notodontids, *Hypsoides* (*Bombyx*) *radama* and *H.* (*B.*) *diego*. They are found in almost all the forests of the eastern slope and the north. These caterpillars enclose their cocoon in a large envelope which they weave in common, and which is sometimes 1 metre in length.

Since the French occupation, especially since 1900, the silk industry in the island has been based on the rearing of *Bombyx mori*. After dealing with the cultivation of the mulberry tree and the technical conditions of silkworm breeding, some information is given on the production of silkworm eggs, cocoons and silk, with some account of the encouragement afforded by the Government to sericulture and of the future prospects for this industry in the island.

Duport (L.) & Hautefeuille (L.). **Gum Lac and the Breeding of** *Tachardia.—Internat. Rev. Science and Practice Agric., Mthly. Bull. Agric. Intell. and Pl. Dis., Rome*, vii, no. 8, August, 1916, pp. 1153–1155. [Abstract from (1) Duport (L.). L'Insecte à Stick-lac; (2) Hautefeuille (L.). La gomme laque et son traitement industriel, in *Bulletin économique de l'Indochine, Hanoï-Haïphong*, nos. 112–116, pp. 182–189 and 872–994, March-April and November-December 1915.] [Received 13th December 1916.]

This study contains a summary of our knowledge of the lac insect, *Tachardia lacca*, Kerr, the life-history of the insect itself being dealt with by the first-named author and the production and preparation of lac by the second.

T. lacca is found principally on *Butea frondosa, Cajanus indicus, Ficus religiosa, Zizyphus jujuba*, and especially *Schleichera trijuga*, which supplies the best gum lac. It is stated that the most suitable spots for production should have a moderately hot climate where the rainfall amounts to about 29·25 inches per annum. Observations made in Indo-China give from 1,310 to 2,130 feet as the limits of altitude. The production of lac is also said to require the presence of a species of large red ant, which, according to the natives, drives away all other ants injurious to the scale. A scheme of research is proposed to complete a survey of the areas likely to be productive, to specify more clearly the nature and distribution of the most useful species or varieties, to study the different kinds of lac produced and the reasons why some kinds are insoluble in alcohol, and to extend the cultivation of *Schleichera trijuga*, which is also useful owing to its edible kernel being rich in oil. Further entomological study of *T. lacca* is also required, especially regarding the economic conditions of its rearing, the trade and exchange of the eggs and the ant associated with it.

Some particulars are also given respecting the plant and appliances required for the refining of gum lac.

Stewart (V. B.) & Leonard (M. D.). **The Part played by Insects in the Spread of** *Bacillus amylovorus.—Internat. Rev. Science and Practice Agric., Mthly. Bull. Agric. Intell. and Pl. Dis., Rome*, vii, no. 8, August 1916, pp. 1198–1199. [Abstract from *Phytopathology, Baltimore, Md.*, vi, no. 2, pp. 152–158.] [Received 13th December 1916.]

This is an account of experiments carried out with a view to ascertaining whether sucking insects are capable of spreading and inoculating healthy plants with *Bacillus amylovorus*. Young pear and apple trees were enclosed in wire cages and cultures of *B. amylovorus* in agar were spread in abundance on some of them. The following insects were introduced into each cage:—*Pollenia rudis*, F., *Empoasca mali*, Le B., *Psylla pyricola*, Forst., *Plagiognathus politus*, Uhler, and *Sapromyza bispina*, Lw. Though the insects were at liberty to go from one plant to another, the disease was unable to spread from the infected to the healthy ones. This is probably due to the fact that some sucking insects are not able to produce lesions of the tissues such as would facilitate the entry of this organism. The false tarnished plant-bug,

Lygus invitus, Say, and the red apple-bugs, *Heterocordylus malinus*, Reut., and *Lygidea mendax*, Reut., are more active in this direction, and the possibility of plants becoming infected through the lesions caused by them cannot be dismissed as improbable.

JOHNSTON (J. R.). **Cultivo del Cocotero.** [Cultivation of the Coconut Palm.]—*Estación Experimental Agronómica, Havana, 1915*, Circular no. 49, 11 pp., 3 plates. [Received 4th December 1916.]

The rhinoceros beetle is a serious pest of coconut in Havana. Spraying with petroleum soap has been found effective, as has also the following preparation : resin, 20 lb. ; caustic soda, 5 lb. ; whale-oil, 25 lb. ; with water sufficient to make 100 gallons of solution.

VAN HERMANN (H. A.) & CUNLIFFE (R. S.). **Cultivo de Hortaliza y Viandas.** [Vegetable Growing.]—*Estación Experimental Agronómica, Havana*, Circular no. 51, 1916, pp. 75, 17 figs.

Vegetables in Cuba do not appear to suffer greatly from the attacks of insects. Lead arsenate is used against biting insects, while thrips and other insects that suck the juices of plants can be controlled by tobacco solutions, or strong soap. Potatoes have recently been attacked in various parts of the island by a new pest, resembling the caterpillar that attacks the tobacco leaf ; this insect perforates stored potatoes, rendering them useless as food. The only known remedy is to cover the storage rooms so as to prevent the adult insects from laying their eggs in the tubers. The weevil, *Cylas formicarius*, attacks sweet-potatoes, boring into the tubers. There is no remedy for this, but the damage can be reduced to a minimum by sowing in light soil and gathering the crop as soon as mature, so that the tubers are not left exposed above the ground. Egg-plants, tomatoes and red-pepper are attacked by crickets, flea-beetles, ants, caterpillars, and Aphids ; Bordeaux mixture should be used as a spray against them.

GIRARDI (I.). **Pulgones de los Vegetales.** [Plant Aphids.]—*Revista Agrícola, Bogotá*, ii, no. 5, May 1916, pp. 303–308. [From *Revista del Ministerio de Industrias.*] [Received 8th December 1916.]

Apart from such well-known pests as *Phylloxera* attacking grape-vines and the woolly apple-aphis [*Eriosoma lanigerum*], there are many other Aphids which cause serious damage in Colombia. They include : *Aphis persicae*, abundant on peach trees during summer and autumn, while *A. amygdali* is more harmful when the trees begin to bud ; *A. cydoniae* on quinces, though not very numerous ; *A. aurantii* on oranges, lemons and mandarins ; *A. vitis* on grape-vines in towns ; *A. rosae* very numerous on roses ; *A. solani* on potatoes, tomatoes and egg-plants, especially when they are infested by *Phytophthora* and other fungi. *Aphis brassicae* is found on cabbages, turnips, mustard, etc., and forms numerous colonies on the under-surface of the leaves of all cruciferous plants. It does considerable damage in orchards, and often completely destroys beds of seedling cabbages and Brussels sprouts. *Aphis rumicis* (*papaveris*) attacks a great many plants, chiefly beans, poppies, chrysanthemums, etc. *Aphis lactucae* occurs

both in the green and brown variety on lettuces, and often destroys a seed-crop. *Pemphigus bursarius* is a gall-forming pest of poplars. Among root-aphids are *A. myrmecaria,* which attacks garden-plants, and *Forda troglodytes,* which infests vegetables.

The basis of the best spray for the control of these Aphids is a solution of potash soap, 1 or 1½ per cent. in water; to this should be added 1 per cent. of extract of tobacco, cresyl or lysol, or ½ per cent. only in the case of very delicate plants. This preparation is rendered much more effective by the addition of a decoction of 2 lb. of the leaves and buds of peach, tomato or potato, in 2 gallons of water. A second spraying should be given after four or five days. For root-aphids, the same mixture can be used to water the ground, thoroughly saturating the area infested by the insects. Calcium carbide also gives good results, using 2 lb. per square yard of ground. When scattered, this should be dug in to a depth of 10 inches. Cyanide of potassium and carbon bisulphide are also efficacious, but their use is somewhat difficult and costly.

These Aphids have many enemies in Colombia, the chief being Coccinellids, Hemerobiids and a small species of ant. The principal enemy of the root-aphids is a fungus, which is unfortunately rare, being apparently unable to resist the excessive heat and prolonged droughts.

La Polilla en las Papas. [The Potato Moth.]—*Revista Agrícola, Bogotá* ii, no. 6, June 1916, pp. 353–355. [From *Revista de las Asociación Rural del Uruguay,* xlv, no. 2, February 1916.] [Received 8th December 1916.]

Phthorimaea operculella (*solanella*) attacks both the growing potato-plant and the stored tubers. The climate of Colombia favours the development of this moth throughout the year. If potatoes are infested at the time of gathering, they should be treated for ten minutes in a bath of 2 per cent. sulphate of copper and should be stored in a room well disinfected with sulphur. If the moths appear in the store-room, 1½ to 2 ozs. sulphur to each cubic yard should be burnt and the room sealed for 48 hours. This should be done once a fortnight, in order to kill the moths which have emerged from the larvae present in the tubers at the previous disinfection. Those varieties in which the tubers grow very near the surface, should be sowed thinly, so that the plants may be well tilled and the tubers will not be exposed to attack. Shoots which have been attacked by the larvae should be cut off and burnt.

Fungicidas e Insecticidas más usados para combatir las Enfermedades de las Plantas. [Fungicides and Insecticides most commonly used to combat the Diseases of Plants.]—*Revista Agrícola, Bogotá,* ii, no. 6, June 1916, pp. 341–348. [Received 8th December 1916.]

The formulae contained in this article have been tested by the Estación de Patologia Vegetal, and used very successfully on a large scale.

Petroleum emulsion, Formula I:—Petroleum, 1½ pints; soap, 2 oz.; water, 2 gals. The soap is dissolved in one pint of water and the petroleum is added gradually, stirring all the time until an

emulsion is formed ; the rest of the water is then added, stirring all the time. Formula II :—Petroleum, $1\frac{1}{2}$ pints ; lysol, 5 oz. ; water, 4 gals. The petroleum (paraffin) and lysol are mixed together, and the water is then added. This emulsion will keep for a long time. These formulae are used against Coccids, Aphids, Thrips, red-spider, or any insect which requires an insecticide that kills on contact.

Tobacco decoction :—Tobacco, or tobacco dust, 6 lb. ; carbonate of soda, 6 oz. ; water, 20 gals. The water is poured into a 20 gals. receptacle and raised to boiling point ; at this moment the tobacco and carbonate of soda are added ; the mixture is boiled for $\frac{1}{2}$ or $\frac{3}{4}$ of an hour and then strained through a piece of sacking. This liquid is used against Aphids.

Calcium polysulphide :—Sulphur, 10 lb. ; recently slaked and sifted lime, 20 lb. ; water, 10 gals. The sulphur is mixed into a paste with a little water, the lime is then added and a little more water to retain the form of a paste ; 10 gallons of water are heated in an iron cauldron, and when at boiling point, the paste of sulphur and lime is added. The mixture is then boiled for from 45 minutes to an hour. When the paste is put in the warm water, a certain quantity of sulphur comes to the surface, and the whole appears yellow ; as it boils, the liquid becomes orange-coloured, and when it begins to turn brown, the operation is finished, and at this moment the froth on the top has a green tinge. The cauldron should then be withdrawn from the fire and allowed to stand for ten minutes until the sediment has settled ; it will then be 14° or 15° Bé. The liquid can be used at once or decanted and kept, but before use, water should be added until 5° Bé. is reached, when the spray is ready for use. This is very effective against Coccids, and should be applied as soon as the leaves have fallen. When badly infested, the trees should be sprayed again in early spring, when the buds begin to swell before bursting. It is also successful as a winter treatment against Coccids, Aphids and similar insects.

Sodium bisulphide :—Sulphur, 48 lb. ; caustic soda (98 per cent.), 24 lb. ; water, 20 gals. In a receptacle of 20 gallons capacity, a paste is made with the 48 lb. sulphur and a little water so that there is no excessive heat. When all the sulphur and soda are dissolved, water is added up to 20 gals. This is the concentrated liquid, of which $1\frac{3}{4}$ lb. should be dissolved in 5 gals. water. This has proved a very successful treatment against red-spider on citrus.

Paris green, for small caterpillars, is used as follows :—Paris green, 6 oz. ; lime, 6 oz. ; water, 20 gals. The Paris green and lime are mixed with a little water into a stiff paste, and the water then added. Against *Cydia pomonella* and *Eriocampoides limacina*, the mixture should be :—Paris green, 4 oz. ; lime, 3 oz. ; water, 20 gals. Lead arsenate as a spray :—Recently slaked and sifted lime, $1\frac{1}{4}$ lb. ; lead arsenate, $1\frac{1}{4}$ lb. ; water, 20 gals. A good poison bait consists of :—Bran, 30 lb. ; molasses, or raw sugar, 4 lb. ; Paris green, 2 lb. These are well mixed and placed during the evening in small quantities at intervals in the line of plants and at their foot.

Carbon bisulphide is used at the rate of 14 oz. per ton of grain, or 1 lb. per 22 cubic yards of space, to kill weevils and Bruchids and other insects that infest granaries and barns. For injection into the ground to destroy various pests, such as *Oniscus*, *Julus* and *Margarodes*, it can be used without danger to vegetation at the rate of 1 oz. per square

yard. Calcium bicarbide may be used instead of carbon bisulphide against root-insects, at the rate of $2\frac{1}{2}$ oz. per tree, placing it in three portions in the form of a triangle at the base of each, at a distance of half a yard from the trunk. As this mixture gives off acetylene, it should be buried 18 inches below the surface; 2 lb. of bicarbide usually gives off 300 litres of gas.

Benzine, as well as carbon bisulphide, is used to kill the larvae of insects that make galleries in tree-trunks. The entrance is opened with a wire, and a little of the liquid is placed inside, the hole being then closed with wax. Lysol has also been successfully used against Scolytids. A thick milk of lime is prepared and 5 per cent. lysol added. This is washed over the trunk and the larger branches in August, and is renewed in spring.

Bordeaux mixture is made from copper sulphate, 4 lb.; recently slaked and sifted lime, 8 lb.; water, 20 gals. The copper sulphate is dissolved in 10 gallons of water; in another vessel a milk of lime is made with the 8 lb. lime and 10 gals. water; when the sulphate is all dissolved, it may be mixed with the lime. This is done in a separate vessel, the milk of lime and the sulphate being added gradually, in equal proportions, stirring all the time. Wooden vessels must be used. If the lime used is not of good quality, it may give an acid reaction; the mixture must therefore be tested and more lime added if necessary. This mixture may be used in combination with arsenical salts.

The following formulae for formalin solutions for disinfecting potatoes before sowing are given:—I: Formalin, 40 per cent. strength, 1 lb.; water, 20 gals.; the potatoes should be submerged for $1\frac{1}{2}$ to 2 hours. II: Permanganate of potash, $11\frac{1}{2}$ oz.; formalin, $1\frac{1}{2}$ pints. This is sufficient to disinfect 11 cubic yards, the potatoes remaining submerged for 48 hours.

SEMICHON (L.). **Emploi des Composés Arsenicaux en Viticulture.** [The use of Arsenical Compounds in Vineyards.]—*Rev. Viticulture, Paris*, xlv, no. 1169, 23rd November 1916, pp. 338–341.

According to regulations issued up to 15th September 1916, arsenical compounds intended for use against insects harmful to vines can be employed only if insoluble [see this *Review*, Ser. A, v, p. 47]. They may be used only from the beginning of the growing season up to the end of the flowering season. The storing and handling of these products in vine-growing operations are subject to very severe and exacting regulations and any offence against these is punishable by fine or imprisonment or both.

It is realised by vine-growers that owing to the conditions under which these compounds were formerly sold, these regulations are necessary, though, in spite of the large quantities dealt with, accidents were extremely rare.

The arsenical compounds generally used in vine-growing may be divided into two groups:—The arsenates of soda, lime, copper, zinc and lead, used from the bursting of the leaf-bud until the flowering season, and the compounds having as a base arsenite of soda or arsenic acid, used generally during the winter, principally against *Sparganothis pilleriana*, and to a certain extent against *Clysia ambiguella* and *Polychrosis botrana.*

Growers are therefore limited in the first case to the arsenates of lead and lime. These were formerly prepared on the spot by mixing a soluble salt of lead or milk of lime with a solution of arsenate of soda. The arsenates of lead or lime thus formed and used at once remained in a better state of suspension than is obtained by dissolving in water arsenates of lead or lime, dry or in a paste, as sold commercially. Under these circumstances the use of a hot-water spray is recommended.

The second group of compounds are all forbidden, both because they are soluble and also because they are used during the prohibited season. Here again hot-water spraying is the only efficacious alternative, and if this has to be adopted, it will lead to a great consumption of fuel at a time when it can ill be spared. The removal of the present restrictions and the substitition of washing with arsenical compounds for hot-water spraying would effect a saving of from 50,000 to 100,000 tons of coal. The author therefore advocates that the use of arsenicals should be authorised during winter up to the bursting of the leaf-buds.

Droits de Douane sur les Arséniates et Acétates de Plomb. [Customs Duties on Arsenates and Acetates of Lead.]—*Rev. Viticulture, Paris,* xlv, no. 1169, 23rd November 1916, p. 345.

In France arsenate of lead is subject to an import duty of 5 % of its value plus 2*s.* per 220 lb. net at the general rate and 5 % plus 1*s.* 8*d.* at the minimum rate.

Acetate of lead is subject to an import duty of 12*s.* 3*d.* per 220 lb. net at the general rate and 6*s.* 4*d.* per 220 lb. at the minimum rate. Importations direct from the United States to France are subject to the general rate, but if they come *via* any other European country they are subject to a surtax of 3*s.* per 220 lb. Importations of English origin are subject to the minimum tariff.

Roepke (W.). (1) **Sprinkhanenplagen.** [Locust Plagues.]—Reprints from "*Teijsmannia,*" *Batavia,* 1915, nos. 1 & 2, pp. 115–124, nos. 6 & 7, pp. 337-358 and no. 12, pp. 758–790, 8 plates, 2 figs.
(2) **Sprinkhanen op Java.** [Locusts in Java.]—Separate from *De Indische Mercuur,* 14th July 1916, 13 pp. [Received 11th December 1916.]

It is now a little over two years since the appearance of locusts in Java in large numbers began to cause serious alarm. They are by no means new to the island, as they are mentioned as far back as 1878. The primary focus of infestation is in the teak forests of Middle Java, which extend irregularly from East to West for 125 miles, and are estimated to cover nearly 2,000 square miles of country. In addition to this primary focus, the localities of five secondary ones are given; these are outside the teak forests, which are from 200 to 320 feet above sea-level, while the elevation of one of the secondary areas is nearly 2,700 feet.

The destructive species in Java is believed to be *Cyrtanthacris melanocornis,* Serv. (*nigricornis,* Burm.), which is described at length, with photographs. According to Koningsberger, *C.* (*Acridium*) *rosea,* De G., probably does not occur in Java. There is however some doubt as to the species, as it is not identical with that occurring in the Straits Settlements, the Philippines or Celebes. In normal years when the

east monsoon is not too dry, this insect occurs more or less sporadically, though it is to be found the whole year through in all stages of development.

The bionomics of this locust are not thoroughly known, and many important points still require investigation. The eggs are laid in any kind of soil about 3 inches below the surface. Three months are required from the egg for the insect to become winged, and the adults live about two months, pairing taking place in the last month of life. In years which are not very dry, the eggs hatch out in a few weeks; drought delays the hatching, which does not take place until a considerable amount of rain has fallen in November or December; in this case there will be a more or less sudden appearance of the insects in large numbers. About the end of the west monsoon, these will be full grown and the eggs will be laid more or less at the same time. If the new east monsoon is then very dry, at the end of it there will be a still greater accumulation of locusts, and if these conditions be repeated a third time, the number of locusts in the next west monsoon may reach disquieting proportions. This is the explanation suggested for the connection between dry years and the locust plague in Java. The view that the eggs may lie unhatched in the ground for several years is regarded as untenable, although eggs that have been kept dry in the laboratory for over a year have been found to be still living. The local outbreaks of 1914, followed by a general and serious infestation of all wooded areas in 1915, are considered to bear out the theory of delayed hatching between the monsoons. In the latter year, the damage done in some places is said to have been indescribable.

The desire of the locusts for sunlight and warmth causes them to attack the tops of the trees first. The damage to old trees is not very serious; the younger the tree, whatever the species, the greater the damage. When the winged stage is reached, the insects exhibit a marked tendency to change their locality, but this movement, though more or less general, is not comparable with that of other well known species which migrate in vast swarms. The Java locust spreads steadily from the teak forests and gradually invades the surrounding cultivated land and this process may go on for several weeks. At a distance of a little over three miles the danger to crops is usually small.

The food-plants of this locust are discussed at length. The plants that are regarded as safe from attack, include:—Mahogany, rice, lalang grass [*Imperata cylindrica*], *Saccharum spontaneum*, and *Coleus tuberosus* (black potato). *Castilloa*, bread-fruit, *Ficus* and *Hevea* are favourite food-plants, and are all eaten in the same manner, the young leaves at the tips of the branches being generally spared. The green shell of Java coffee is eaten, but not that of *Coffea robusta*. Coconut palms almost beyond the danger zone are often seriously attacked, while other crops near by are left. Sorghum is but slightly attacked, though maize suffers seriously.

The secondary foci outside the teak forests are productive of much greater damage to crops, as in these the insects are not immigrants, but residents.

In dealing with the question of control, all the well-known methods are reviewed in relation to the habits of the Java locust. A fungus, at present indistinguishable from *Metarrhizium anisopliae*, plays a very

important part in its destruction. All stages are attacked, especially the adults, including many females before oviposition. Experiments on its transmission in the laboratory proved valueless, as the controls were all found to be infected. Egg-masses are often found which are of the same red colour as locusts killed by this fungus, and it seems probable that their colour is derived from the infected female, as hoppers hatched from these die soon after emergence. A wet monsoon, which favours the rapid hatching of the eggs, also favours the fungus, which under these conditions spreads rapidly. Two insect parasites of *C. nigricornis* are described. *Mylabris pustulata*, Thb., appeared in 1915 in large numbers in connection with locusts. The adult beetles do some damage to cultivated plants; they live for many months and the female lays many hundred eggs in the upper layer of the soil, the larvae destroying large quantities of locust egg-masses. The second egg-parasite is *Scelio javanica* [see this *Review*, Ser. A, iv, p. 480], which also destroys large numbers of eggs. It is uncertain whether there is more than one generation of this Hymenopteron in the season. Zimmerman kept the egg-masses in open boxes so that the parasites could escape, while the hoppers died from starvation, and there is no doubt that the application of this system on a larger scale, using boxes covered with wire gauze, would be of value. The habits of *C. melanocornis* do not permit of the use of the ordinary mechanical methods of locust control to any great extent, though they should not be neglected. If early information as to the appearance of the hoppers in quantity is obtained, they can be driven into fires or trenches in the usual manner, and men with sprayers should follow the drivers and spray the insects with petroleum emulsion to prevent them from climbing bushes, etc., and so escaping. The systematic collection of the egg-masses is a thoroughly practicable and effective method of arresting the spread of the pest, and in the district of Salatiga on three plantations alone 1,100,000 egg-masses were collected; the operation is simple on cultivated areas, but on waste land and in the bush it is far from easy. The various sprays and poisoned baits which have been used against locusts are discussed at length, but these can only be used successfully in open ground, whereas the whole difficulty of dealing with the Java locust lies in its chief breeding places being in the teak forests and the bush between and around them. A list of the more important papers and reports on locust control concludes this paper.

BENZIN (V.). **Вредители зерна и муки, заготовляемыхъ для арміи въ Области войска Донского.** [Pests of Grain and Flour purchased for the Army in the Province of Don.]—**« Земледѣльческая Газета.»** [*The Agricultural Gazette*], *Petrograd*, no. 3 (119), 29th January 1916, pp. 61–63. [Received 5th December 1916.]

Grain kept in the warehouses at the railway stations in the province of Don proved to be heavily infested with *Calandra granaria*, L., in the spring of 1915. This had not been observed prior to the war, as the grain remained only a short time in the warehouses and was constantly removed and shipped abroad. In some places recourse was had to cleaning of the grain by means of machinery and on one elevator alone nearly 300 tons of offal containing the weevils were burned

during June–August. Macaroni in bags kept in a warehouse with bags of infested barley was also attacked. A systematic campaign against this pest in railway warehouses is necessary, and its success will largely depend on the provision by the railway companies of new iron and concrete buildings, as the existing wooden ones provide safe hiding places for the weevils and defy all attempts to control them by fumigation and disinfection. The grain was also infested with mites. Flour was seriously attacked by *Ephestia kühniella* and other pests; against these, fumigation with carbon bisulphide must be thoroughly carried out in specially built disinfecting chambers.

S. **Саранча въ Семипалатинской области.** [*Pachytylus migratorius* in the Province of Semipalatinsk.]—**« Земледѣльческая Газета.»** [*The Agricultural Gazette*], *Petrograd*, no. 4 (120), 5th February 1916, pp. 99–100. [Received 5th December 1916.]

An enormous outbreak of *Locusta* (*Pachytylus*) *migratoria* took place in August 1915 in the province of Semipalatinsk in Russian Central Asia. So vast were the swarms in the middle of October that they are said to have obscured the sun and caused domestic animals to stampede. Dogs, foxes, wolves and the steppe birds became fat on a diet of these insects. As the harvest was practically over at the time of the outbreak, no serious damage was done, but the locusts infested with their egg-clusters an area of over 5,000 square miles. The Department of Agriculture has therefore been approached by the Provincial Authority with a request to organise a campaign against these insects, and to sanction an expenditure of £10,000 from local funds for this purpose.

Uvarov (B. P.). **Еще о техникѣ борьбы съ саранчевыми.** [Further Notes as to the Technique of the Control of Locusts.]—**« Земледѣльческая Газета.»** [*The Agricultural Gazette*], *Petrograd*, nos. 8 & 9 (124 & 125], 5th & 12th February 1916, pp. 204–205 & 227–229. [Received 5th December 1916.]

This paper is a reply to the remarks of E. V. Jatzentkovsky on a previous article by the author [see this *Review*, Ser. A, iii, p. 98 and 642], who here reiterates his former views as to the advantages of the use of poisoned baits against locusts.

Uvarov (B. P.). **Вредны-ли опрыскиванія мышьяковистымъ натромъ?** [Is Spraying with Sodium Arsenite injurious?] —**« Земледѣльческая Газета.»** [*The Agricultural Gazette*], *Petrograd*, no. 18 (134), 13th May 1916, pp. 496–497. [Received 5th December 1916.]

The author refers to a note published by the Honolulu Experimental Agricultural Station as to the dangerous effects of spraying with sodium arsenite. This, if correct, would be of practical importance in Russia, where the use of this insecticide has been increasing of late in the campaign against locusts. Not having seen the original work, which described experiments with this insecticide as a means of controlling weeds, the author assumes that the strength of the solution for this

purpose was greater than that used against locusts and that the spraying was repeated many times on the same spot. Neither of these considerations applies to the campaign against locusts, and even should further research confirm the injurious effects of sodium arsenite to plants, its value against locusts would not be affected owing to the recent practice of using it in poisoned baits instead of in sprays.

Энтомологическое совѣщаніе при департаментѣ земледѣлія. [An Entomological Conference at the Department of Agriculture.] — **« Земледѣльческая Газета.»** [*The Agricultural Gazette*], *Petrograd*, no. 21 (137), 3rd June 1916, p. 594. [Received 5th December 1916.]

An entomological conference took place at the Department of Agriculture at Petrograd on 12th May 1916, at which the following subjects were discussed :—(1) The position of the entomological experts of the Department and their part in practical local work ; (2) the scientific questions that could be studied during campaigns against large outbreaks of pests and by whom they ought to be carried out ; (3) the control of those pests which have as yet been insufficiently studied and the steps necessary to render it more complete ; (4) the subjects to be dealt with in the next publications of the Department ; (5) the organisation of publications of the various local stations so as to prevent overlapping ; (6) the training of experts in entomology ; (7) the better organisation of the control of pests ; and (8) the establishment of new stations and the co-ordination of their work.

Rossikov (K. N.). **Весенній врагъ капусты—капустная блоха и простѣйшіе способы борьбы съ ней.** [The Spring Pests of Cabbage—Flea-beetles and the simplest Remedies for their Control.] — **« Земледѣльческая Газета.»** [The Agricultural Gazette], Petrograd, no. 22 (138), 10th June 1916, pp. 602–606, 6 figs. [Received 5th December 1916.]

Cabbages in the government of Petrograd, as well as in Novgorod, Pskov and Tver, suffer a great deal from insect pests, especially in spring. In 1913 and again in 1914 and 1915 some 75 per cent. of the crop was destroyed. The chief damage was done by *Phyllotreta* spp., especially *P. atra* and *P. nemorum*. The adults hibernate and appear early in spring on various cruciferous weeds, on which they are able to live in the absence of suitable cultivated plants. These weeds must therefore be destroyed some time before transplanting cabbages.

Only one generation occurred in 1914 in Petrograd, and this appears to be the rule, although there are two or three in southern Russia. The most favourable years for the multiplication of these beetles are those with a hot, dry summer and a warm, dry autumn. Control experiments were carried out in one market-garden in 1914, and for this purpose beds of cabbage were divided into 12 separate plots and each of them subjected to separate treatment. These were powdered with various substances, of which the most effective and most easily handled were ashes, road-grit, lime, basic slag and sawdust. Trap crops of summer cabbage, kohl-rabi and turnips were also found to be of some value.

Paczoski (J. K.). **Обзоръ враговъ сельскаго хозяйства Херсонской губерніи и отчетъ по естественно-историческому музею за 1915–1916 годъ.** [Review of the Pests of Agriculture in the Government of Kherson and Report of the Natural History Museum for 1915–1916], *Kherson,* 1916, 7 pp.

The larvae of *Anisoplia austriaca* were found in large numbers in the spring of 1916 during the ploughing of the fields for the spring sowing, but, as was the case in the preceding year, the adults were far less numerous than might have been expected. This is attributed to the rainy spring, which affects the development of the mature larvae. *Epicometis hirta*, which is a serious pest of orchard and also injures rye, was not numerous; *Oscinella* sp. chiefly attacked oats and barley, which were also injured by *Mayetiola destructor*, *Cephus pygmaeus*, and *Pyrausta* (*Botys*) *nubilalis.* Serious injuries were again caused to steppe-grasses by *Cledeobia moldavica* [see this *Review*, Ser. A, iv, p. 56], which, according to the latest observations, also attacks *Poa bulbosa vivipara* in the absence of *Festuca sulcata.* This Pyralid was also numerous in an adjoining part of the neighbouring government of Taurida, where it has destroyed *Stipa capillata.* Lucerne was injured by larvae of *Otiorrhynchus ligustici* and some unidentified insects injured the roots of *Euphorbia gerardina*, which is a noxious weed of pasture land.

Orchards were attacked by the usual pests, including:—*Euproctis chrysorrhoea*, *Malacosoma neustria*, *Hyponomeuta malinellus*, *H. variabilis*, *Cydia pomonella*, *Acronycta tridens*, etc. Reference is made to a statement in the report for 1914–1915 of the Bio-Entomological Station of Kishinev to the effect that *Eriosoma* (*Schizoneura*) *lanigerum* has been discovered in a district of the government of Kherson adjoining Bessarabia and that it is from there also, and not only from Rumania, that the Bessarabian vineyards have been invaded by this pest. *Calandra granaria* was reported from several localities.

Shtcherbakov (Th.). **О работахъ отдѣла энтомологіи Шатиловской С. Х. Опытной Станціи.** [The Work of the Entomological Section of the Shatilov Agricultural Experimental Station.]—**«Южно-Русская Сельскохозяйственная Газета.»** [*The South Russian Agricultural Gazette*], *Charkov,* xviii, nos. 34 & 35–36, 28th September and 12th October 1916, pp. 8–9 & 9–10.

In addition to the study of the relationship between weevils of the genus *Apion* and the harvest of clover seed [see this *Review*, Ser. A, iv, pp. 142 and 334], which was the principal work of this station, investigations on *Bruchophagus gibbus* showed that this Chalcid was not seriously injurious in 1914 and 1915 and that other related species also breed in the seeds of clover. An internal parasite of *Apion*, belonging to the Braconid genus *Dinocampus*, was discovered in 1916. It was also found that *Apion* spp. can complete their development from egg to adult on the vegetative parts of the clover plant, which had hitherto been regarded as impossible.

Berger (B.) & Cholodkovsky (N.). **Къ біологіи и анатоміи коро-ѣдовъ рода** *Scolytoplatypus*, Blandford (Coleoptera, Ipidae). [On the Biology and Anatomy of the Genus *Scolytoplatypus*.]—**«Русское Энтомологическое Обозрѣніе.»** [*Revue Russe d'Entomologie*], *Petrograd*, xvi, no. 1–2, 28th October 1916, pp. 1–7, 7 figs.

In the summer of 1915 the first-named of the authors of this work collected a great number of bark-beetles of the genus *Scolytoplatypus*, Blandf., from a forest containing both deciduous and coniferous trees, near Vladivostok. These beetles are on the wing in May and June and occur mostly in shaded, damp places. A variety of trees were cut down and left as baits, and it was found that the most attractive were maples, *Acer mono* and *A. mandschuricum*. The galleries of these beetles, which resemble those of *S. tycon*, Blandf., occurring in Japan, are described. The authors believe that this species will prove to be new and call it provisionally, *S. ussuriensis*, sp. n. An English summary is appended and contains also a description of some of the characters distinguishing the females from the males.

Spessivtzev (P.). **Два новыхъ вида** *Carphoborus* **изъ Восточной Россіи.** [Two new Species of *Carphoborus* from East-Russia.] (Coleoptera, Ipidae).—**« Русское Энтомологическое Обозрѣніе.»** [*Revue Russe d'Entomologie*], *Petrograd*, xvi, no. 1–2, 28th October 1916, pp 64–67, 4 figs.

This is a description in English of two new species of *Carphoborus*, viz :—*C. cholodkovskyi*, sp. n., found under the bark of dying *Pinus silvestris*, and *C. teplonchovi*, sp. n., found in that of dead *Picea obovata* and *Abies sibirica*, in Perm and Vologda. The galleries of both these Scolytids resemble those of *C. minimus*, F., which occurs on *Pinus silvestris* all over central and southern Russia and nearly the whole of Europe, and of *C. rossicus*, Sem., boring in *Picea*, which also occurs in Russia.

Goriainov (A. A.). **Работы бюро въ области прикладной энтомологіи и фитопатологіи въ 1915 году.** [The Work of the Bureau relating to Applied Entomology and Phytopathology in 1915.]—Published by the Entomological Bureau of the Zemstvo of the Govt. of Riazan, *Riazan*, 1915, 138 pp.

This report covers the first year of the existence of the Bureau and gives an elaborate account, containing many tables, calculations and formulae, of the investigation as to the pests of clover carried out on the lines laid down by the Tula conference [see this *Review*, Ser. A, iv, p. 292 *sqq.*]. The conclusions arrived at are summarised as follows: *Apion* sp. is undoubtedly a pest of clover seed, and in the year under report it has caused damage varying from 5 to 36 per cent. and a reduction of seed varying from 2 to 55 per cent. The weevils injure both pollenised and unpollenised flowers, the percentage of the shortage of seed roughly approaching that of injured flowers, though there is no

connection between the percentage of infestation and the damage done, nor between the attacks of the weevil and the size of the clover heads. Mowing increases the number of flowers in the head by 50–60 per cent.; both the percentage of infestation and the damage done are lower in the case of mown clover. Wild clover provides favourable conditions for the breeding of *Apion* before invading cultivated areas.

This report also includes an account of the investigation into different vegetable insecticides [see this *Review*, Ser. A, v, p. 24] and gives a list of insect pests recorded during the year. *Hyponomeuta malinellus*, Zell., was not numerous, while *H. padi*, Zell., was present in large numbers and seriously injured bird-cherry trees in some localities, but did not attack apples. Owing to the attacks of parasites, the numbers of *Aporia crataegi* were smaller than in the previous year. Other orchard pests were *Malacosoma neustria*, *Euproctis chrysorrhoea*, *Episema* (*Diloba*) *coerulocephala*, *Cheimatobia brumata*, *Psylla mali*, which did a great deal of damage and was controlled by fumigating with tobacco dust and straw, and a number of Aphids, including *Aphis ribis* on cherries, *Aphis cerasi* and others. *Coccinella septempunctata* was active in destroying these pests, though some cocoons of *Perilitus, terminatus*, Nees, a Braconid parasite of Coccinellids were found amongst them. Great damage was done by *Anthonomus pomorum*, L., the oviposition period being much extended, so that at the end of May damaged buds contained both larvae and pupae. Red currants were attacked by two generations of *Pteronus ribesii* (*Nematus ventricosus*), and it was found experimentally that the injured berries lose up to 48 per cent. of their weight, besides being inferior in flavour. The second generation was effectively checked by spraying with "Mortus." Injuries by *Eriophyes pyri* to pear leaves were observed nearly everywhere. *Phyllotreta* spp. attacked cabbages, radishes and kidney beans throughout the summer; powdering with ashes and basic slag proved very effective, while spraying with Paris green ($4\frac{1}{2}$ oz. of green, $4\frac{1}{2}$ oz. of lime, or $2\frac{1}{2}$ lb. of soap in about 3 gallons of water) was unsatisfactory. Mustard was attacked by *P. atra*, and barley and wheat in the same locality by *P. vittata*. Sheets covered with adhesives may be used against both these pests. *Pieris brassicae*, *P. rapi*, *P. napi*, and *Barathra* (*Mamestra*) *brassicae* were very injurious, the last-named being parasitised by an unidentified Chalcid. *Chortophila brassicae* was reported from several localities, as was also *Gryllotalpa gryllotalpa*. *Agriotes lineatus* and *Athous niger* attacked beets, potatoes and winter crops.

Several tables are given showing the distribution in time of *Euxoa segetum* and *Feltia exclamationis*, as indicated by the numbers caught in troughs with molasses, the maximum period for both species being during the first week in July. Practically no second generation occurred. Of the adults of *E. segetum*, 80·2 per cent. were males and 19·8 per cent. females, while of *F. exclamationis* the males numbered only 12·9 per cent. and the females 87·1 per cent. *Mayetiola destructor* seriously injured winter rye in one locality, and the author recalls the fact that in the late seventies and early eighties of the last century this Cecidomyid was such a serious pest in Riazan that a special bye-law was passed by the Zemstvo fixing a date-limit for the sowing of winter crops. In another locality summer rye on a small area was injured by *Oscinella* sp.

Lebedev (F. N.). **Отчетъ о борьбѣ съ кобылкой въ Тобольской губерніи въ 1913 году.** [Report on the Campaign against Grasshoppers in the Govt. of Tobolsk in 1913], *Petrograd*, 1915, 70 pp., Supplements 84 pp., 3 figs., 11 maps. [Received 27th December 1916.]

In the introduction to this report the author points out that the chemical method of controlling locusts is the most practical one and at the same time the least expensive. The fact that it still meets with opposition and is frequently reported not to have proved successful is due to a variety of causes, such as the carrying out of the campaign too late, after the pests have multiplied to an enormous degree and infested large areas, the unsatisfactory character of the insecticide or sprayers used and the technical execution of the campaign, of which the lines have been more or less settled for *Locusta migratoria*, L., but which cannot be carried out with the same success against other species, particularly the smaller and more sluggish northern ones. To the latter group belong the grasshoppers met with by the author during his supervision of the campaigns in Orenburg in 1901–1905 and in Tobolsk in 1913 which are here dealt with.

These grasshoppers, which include *Arcyptera* (*Stethophyma*) *flavicosta*, Fisch., *Oedipoda coerulescens*, L., *Podisma* (*Pezotettix*) *pedestris*, L., *Gomphocerus sibiricus*, L., and various species of *Stenobothrus*, inhabit large areas of European and Asiatic Russia. They differ from the other species in that they do not migrate over large distances or collect into large swarms, while they oviposit anywhere, not necessarily in any special kind of soil. The true locusts found in Russia are divided into two groups: (1) *L. migratoria* and *L. danica*, which breed in the flooded deltas of the Danube, Volga and other large rivers; these migrate for great distances and, having collected into enormous swarms, oviposit among reeds, etc. (2) *Dociostaurus* (*Stauronotus*) *maroccanus* and *Calliptamus* (*Caloptenus*) *italicus*, which occur in Turkestan, Transcaucasia, and a large part of southern Russia; they migrate over smaller distances and oviposit only on hard virgin soil, having collected into more or less large swarms. The method of oviposition is of practical importance in deciding how to conduct investigations as to the infestation of the soil with egg-clusters, on which the preparations for a proposed campaign are based.

In Tobolsk the prevailing species were *Gomphocerus sibiricus* and *Dociostaurus* (*Stauronotus*) *brevicollis*; the next place being taken by *Arcyptera flavicosta*. A full account of the campaign is given, illustrated and supplemented by a number of figures, tables, maps and diagrams. It was conducted entirely by means of the chemical method and was confined to the protection of grain crops. The spraying operations extended over an area of nearly 100,000 acres. A sum of about £17,500 was assigned for this purpose, the insecticides used being Paris green, of which 4 lb. per 2·7 acres was used, and sodium arsenate and arsenic, of which only $2\frac{1}{4}$ lb. were required, the last two thus proving more economical. The use of sodium arsenate is specially recommended; the amount and composition of this insecticide required per 2,700 acres being:—one ton of the arsenate, $1\frac{1}{4}$ tons of black molasses, and $1\frac{2}{3}$ tons of lime; the latter may be replaced by zinc oxide.

Энтомологическій Кабинетъ. Отчетъ о дѣятельности Тифлисскаго Ботаническаго Сада за 1914 годъ. [The Entomological Cabinet. Report on the Work of the Tiflis Botanical Garden in 1914.]—Supplement to **«Труды Тифлисскаго Ботаническаго Сада.»** [*Transactions of the Tiflis Botanical Garden*], *Tiflis,* vol. xvii, 1915, pp. 64–68. [Received 29th December 1916.]

This report covers the years 1913 and 1914 and deals shortly with the work done during this time, a full report on the scientific studies of insect pests of Trancaucasia being in the course of preparation. Special attention was paid to *Heliothis obsoleta* (*armigera*) and *H. peltigera*, a large outbreak of which occurred in 1914, and to their parasites, as well as to *Cydia pomonella* and its parasite *Apanteles* sp., *Chionaspis euonymi*, and several other pests. In the autumn of 1913, lectures on pests and their control were arranged.

Fulmek (L.). **Schäden durch Wiesenwanzen auf dem Weinstock.** [Plant-bug Injury to the Grape-vine.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart,* xxvi, no. 6–7, 16th September 1916, pp. 323–329, 7 figs. [Received 16th December 1916.]

In 1914 specimens of *Lygus spinolae*, Mg., were received from south Tyrol, where this insect was injuring grape-vines, and in April 1916, *Lygus pratensis* (tarnished plant-bug) was sent in from the vine-growing districts in Styria, where it occurs everywhere, though it apparently prefers well-manured stocks in the first or second year after manuring. This bug does considerable damage to the foliage of vines and severe infestation may cause the very young leaves to wither entirely. Clean culture and the removal of all rubbish, etc., which may afford shelter in winter, appear to be the most important control measures.

Ripper (M.). **Bericht über die Tätigkeit der k. k. landwirtschaft.-chemischen Versuchsstation in Görz im Jahre 1914.** [Report on the Work of the Royal & Imperial Agricultural-Chemical Experiment Station in Gorizia in 1914.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart,* xxvi, no. 6–7, 16th September 1916, pp. 388–389. [Abstract from *Zeitschr. f. d. landw. Versuchswesen in Oesterr., Vienna,* xviii, 1915, pp. 203–242.] [Received 16th December 1916.]

In the Gorizia district the Chalcid, *Prospaltella berlesei*, has controlled *Aulacaspis pentagona* sufficiently to render the introduction of the Coccinellid, *Rhizobius lophantae*, superfluous. Both the first and second generations of *Clysia ambiguella* were scarce in the vineyards, which were heavily infested with *Byctiscus betulae*, *Anomala oblonga*, the larvae of *Pergesa* (*Deilephila*) *elpenor*, *Pulvinaria betulae* and *Eulecanium* (*Lecanium*) *corni*. Fruit trees were attacked by *Telephorus* (*Cantharis*) *fuscus*, prunes by *Neurotoma flaviventris*, and prunes and cherries by *Eriocampoides limacina*, which were successfully controlled with powdered lime and sulphur. Many cherry trees were defoliated by *Cheimatobia brumata*. Warm water proved an efficient control for *Aphelenchus ormerodis* infesting chrysanthemums, while carbon bisulphide is not recommended for this purpose. Laurels were attacked by *Coccus* (*Lecanium*) *hesperidum*, *Euonymus* by *Chionaspis euonymi*, *Robinia* by *Eulecanium corni* and mulberries by *E. corni*, *E. persicae* (*L. cymbiforme*) and *Pulvinaria betulae*.

Lingelsheim (A.). **Durch Hemipteren verursachte Missbildungen einiger Pflanzen.** [Malformations of some Plants caused by Hemiptera.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart,* xxvi, no. 6–7, 16th September 1916, pp. 378–383, 3 figs. [Received 16th December 1916.]

In the spring of 1916 a number of galls mainly due to Aphids were noticed in the Royal Botanical Garden at Breslau. These included :—*Aphis viburni,* Scop., on *Philadelphus latifolius* and *P. pubescens*; *A. crataegi,* Buck., *Psylla crataegi,* Schr., and *Myzus oxyacanthae,* Koch, on the hybrid, *Crataego-Mespilus*; *A. pomi,* de G., and *A. fitchi,* Sand., on *Mespilus germanica*; *A. cerasi,* Schr. (*A. prunicola,* Kalt.) on *Prunus americana*; *A. euonymi,* F., on *Euonymus verrucosa, E. europea,* and *E. bungeana*; and the Cecidomyid, *Perrisia fraxini,* Kieff., on *Fraxinus holotricha.* A bibliography of seven works is appended to this paper.

Slaus-Kantschieder (J.). **Bericht über die Tätigkeit der k. k. landw. Lehr- und Versuchsanstalt in Spalato im Jahre 1914.** [Report on the Work of the Royal and Imperial Agricultural Institution for Teaching and Experiments at Spalato, in 1914.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart,* xxvi, no. 6–7, 16th September 1916, pp. 389–390. [Abstract from *Zeitschr. f. d. landw. Versuchswesen in Oesterr., Vienna,* xviii, 1915, pp. 243–266.] [Received 16th December 1916.]

In the Spalato district scrubbing and spraying have failed to control *Aulacaspis pentagona,* nor has *Prospaltella berlesei* proved of use. This scale has also infested tomatoes.

Rörig (G.). **Schädlinge an Hülsenfrüchten.** [Pests of Leguminosae.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart,* xxvi, no. 6–7, 16th September 1916, p. 411. [Abstract from *Kais. Biol. Anst. f. Land- u. Forstwirtsch.* Flugbl. 58, 1915, 4 pp.] [Received 16th December 1916.]

This circular deals with *Bruchus granarius, B. pisorum* (*pisi*), *B. lentis, Sitones lineatus, Cydia* (*Grapholitha*) *nebritana, C.* (*G.*) *dorsana, Polia* (*Mamestra*) *pisi,* and *Scotogramma* (*M.*) *trifolii.* Against the grain weevils, shelled peas should be put in cold storage until February, when they should be placed in rooms heated to 50°–68° F. This will cause the weevils to emerge and they may then be sifted out. Spraying with hellebore-soap or tobacco-hellebore-soap is recommended against *S. lineatus.* The moths can only be checked by cultural measures.

Largeau (F.). **Bekämpfung der Schildläuse der Kokospalme auf den Neu Hebriden.** [Combating Coccids of the Coconut Palm in the New Hebrides.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart,* xxvi, no. 6–7, 16th September 1916, p. 418. (Abstract from *Revue agricole, Noumea,* no. 45, 1916, p. 59.) [Received 16th December 1916.]

The Australian Coccinellid, *Cryptolaemus montrouzieri,* has been introduced into the New Hebrides and has proved an active enemy of the several scale-insects injurious to coconut palms.

BAER (W.). **Ueber Laubholzblattwespen.** [The Saw-flies of Deciduous Trees.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart,* xxvi, no. 6–7, 16th September 1916, p. 436. (Abstract from *Naturw. Zeitschr. f. Forst- u. Landwirtschaft,* 1915, pp. 225–249, 1 fig.) [Received 16th December 1916.]

Detailed accounts, obtained from the author's own breeding experiments and from available literature, are given of the habits and development of the following saw-flies of deciduous trees :—*Hemichroa crocea,* Geoffr., on black alder and birch ; *Pristiphora conjugata,* Dahlb., *Pteronidea miliaris,* Pz., *P. pavida,* Lep., *P. melanaspis,* Htg., *P. salicis,* L., *P. melanocephala,* Htg., *P. ferruginea,* Fst., *P. cadderensis,* Cam., *Eriocampa ovata,* L., and *E. umbratica,* Kl. Keys to the larvae and imagines of the genus *Pteronidea* are given.

WICHMANN (H.). **Borkenkäfer Istriens.** [The Bark-Beetles of Istria.] —*Zeitschr. f. Pflanzenkrankheiten, Stuttgart,* xxvi, no. 6–7, 16th September 1916, pp. 432–433. (Abstract from *Entomolog. Blätter,* xii, 1916, pp. 11–29.). [Received 16th December 1916.]

In these notes on the bark-beetles of Istria, it is stated that the galleries of *Scolytus* (*Eccoptogaster*) *pygmaeus,* F., in *Ulmus campestris suberosa* differ from those described by Shevirev, the maternal passage being regular and larval passages radiating rather straight to the sides. *Phloeophthorus brevicollis,* Kol., which has so far been reported only from the Caucasus and the Crimea, was found on *Colutea arborescens. P. latus,* sp. n., a large dark species, occurred on *Spartium junceum. Phloeosinus serrifer,* sp. n., which is related to *P. thujae,* was found on *Cupressus sempervirens* and *Juniperus communis. Kissophagus erinacellus* occurred in Corfu. *Liparthrum colchicum,* Sem., was found on *Laurus nobilis* ; this species has hitherto only been reported from the Caucasus; its eggs are destroyed by the mite, *Notaspis alatus,* Herm. *L. albidum,* sp. n., was found on *Spartium junceum. Pityophthorus carniolicus,* Wichm., infests *Pinus austriaca.*

This paper is completed by a supplement by F. Ruschka on Hymenopterous parasites reared from the above bark-beetles. These include the Braconid, *Ecphylus caudatus,* sp. n., attacking *L. colchicum,* and the Chalcid, *Wichmannia decorata,* gen. et sp. n., from stalks of *Spartium junceum* infested with *L. albidum.*

LEGISLATION.

The Plant Pests Ordinance, 1912.—*Entebbe, Uganda,* 25th November 1916, 1 p.

The following insects and fungi are declared to be pests for the purposes of the above-mentioned Ordinance, and the notice under this Ordinance, dated 21st June 1913, is cancelled.

Coccus viridis (green scale), *Nitocris princeps* (yellow-headed coffee-borer), *Metadrepena glauca* (leaf-eating caterpillar) and *Antestia variegata* (variegated bug), all of which insects attack coffee; *Stictococcus diversiseta* on cacao, and the fungus, *Lasiodiplodia theobromae* (die-back) attacking both cacao and hevea.

Arrêté du 30 décembre 1916 modifiant l'article 2 de l'arrêté du 15 Septembre 1916 fixant les conditions d'emploi des composés arsenicaux en agriculture. [Regulation of 30th December 1916 modifying Article 2 of the Regulation of 15th September 1916 fixing the Conditions governing to the Use of Arsenical Compounds in Agriculture.]—*Jl. d'Agric. Pratique, Paris,* lxxxi, no. 2, 25th January *1917*, p. 32.

Article 2 of the decree of the 15th September 1916, which read as follows: "Treatment with arsenical compounds, either in a powder or as a whitewash, is forbidden in vineyards, orchards and other plantations where market or kitchen gardening are carried on," is now modified.

The treatments authorised are:—In vineyards: from the end of the gathering of the grapes to the end of the flowering season; on apples, pears and plums (excepting all other species of fruit trees, for which these treatments are forbidden): from the end of the fruit harvest until fifteen days after the end of the flowering season, though the treatment must be suspended when the flowering season is at its height; on olives: from the 1st June to the 1st October; on beetroots: up to one month after thinning or transplanting; on osiers: at all times; on trees and nursery shrubs: at all times, if they do not bear fruit intended for consumption.

The Destructive Insect and Pest Act.—*Agric. Gaz. Canada, Ottawa,* iii, no. 11, November 1916, p. 952.

Regulation IV of the above act has been struck out by an Order in Council and the following substituted:—

"IV. An inspector shall have power to enter any lands, nursery, or other premises where there is reason to believe that any of the insects, pests or diseases hereinafter specified (see Regulation X) are or may be present, or where there exists trees, shrubs or other vegetation which prevents the successful control of the said insects, pests or diseases. An inspector shall give such instructions as may be necessary for the treatment or destruction of any tree, bush, crop or other vegetation or vegetable matter or the containers thereof, which may be found or suspected to be infected with, or constitute an obstacle to the successful control of any of the insects, pests or diseases hereinafter specified, and such instructions shall be carried out by the owner or lessee of the infected, suspected or menacing vegetation, vegetable matter or containers thereof, and such remedial treatment shall be carried out and continued until the insect, pest or disease shall be deemed by the inspector to have been exterminated or the menace removed. The inspector shall have power to carry out the required treatment or destruction if necessary."

NOTICES.

Secretaries of Societies and Editors of Journals willing to exchange their publications with those of the Bureau, are requested to communicate with the Assistant Director.

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THE REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

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JORDAN (K. H. C.). **Ueber künstliche Infizierung des Heuwurmes** (*Conchylis ambiguella*, **Hübn., und** *Polychrosis botrana*, **Schiff.**) **mit Schmarotzerinsekten.** [The artificial Infestation of Individuals of the first Generation of *Clysia ambiguella* and *Polychrosis botrana* with Insect Parasites.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxvi, no. 6–7, 16th September 1916, pp. 428–429. (Abstract from *Zeitschr. f. angewandte Entomologie*, ii, 1915, pp. 149–157.) [Received 16th December 1916.]

Specimens of the Tachinid, *Prosopodes fugax*, Rond., obtained from *Hyponomeuta euonymellus*, were placed on larvae of the vine-moths, *Clysia ambiguella*, Hb., and *Polychrosis botrana*, Schiff., on which development was completed. Though *Dibrachys boucheanus* and *Agrypon flaveolatum*, which were also bred from *H. euonymellus*, are both parasites of these moths, oviposition on the larvae was not effected experimentally. The suppression of hedges of *Euonymus* in vine-growing districts would appear to be inadvisable in the light of these experiments.

TÖLZ & HEIKERTINGER. *Psylliodes affinis*, **Payk., der Kartoffelerdfloh.** [*P. affinis*, Payk., the Potato Earth Flea-beetle.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxvi, no. 6–7, 16th September 1916, p. 435. (Abstract from *Zeitschr. f. angewandte Entomologie*, ii, 1915, pp. 1–28.) [Received 16th December 1916.]

The various stages of *Psylliodes affinis*, Payk., are described. The young potato plants are not much injured by this beetle or its larvae, but the foliage of older plants suffers great damage from the feeding of the adult. *P. affinis* also lives on *Lycium*, *Hyoscyamus*, *Atropa* and various species of *Solanum*.

PRELL (H.). **Zur Biologie der Tachinen** *Parasetigena segregata*, **Rond., und** *Panzeria rudis*, **Fall.** [On the Biology of the Tachinids, *P. segregata*, Rond., and *P. rudis*, Fall.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxvi, no. 6–7, 16th September 1916, p. 438. (Abstract from *Zeitschr. f. angewandte Entomologie*, ii, 1915. pp. 57–148.) [Received 16th December 1916.]

While *Parasetigena segregata*, Rond., attaches its eggs to the host larvae, *Panzeria rudis* brings forth its larvae alive and these settle on fir needles, which are the usual food of the larvae of *Panolis flammea* (*piniperda*), the normal host of this Tachinid. The larvae of the nun moth, *Lymantria monacha*, are only attacked when no other suitable host is available.

PAX (F.). **Beobachtungen über das Auftreten der argentinischen Ameise,** *Iridomyrmex humilis*, **Mayr, in Schlesien.** [Observations on the Occurrence of the Argentine Ant, *I. humilis*, Mayr, in Silesia.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxvi, no. 6–7, 16th September 1916, p. 439. (Abstract from *Illustr. schles. Monatsschr. f. Obst-, Gemüse- u. Gartenbau*, 1915, p. 33.) [Received 16th December 1916.]

The Argentine ant, *Iridomyrmex humilis*, Mayr, which is known to occur in the open in Portugal and Bosnia, is recorded in the Botanical

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Garden at Breslau, where it destroys salad immediately after sowing and the blossoms of many useful plants. A bait consisting of sugar mixed with borax or calomel is the remedy advised.

Hinsberg (O.). **Insektenfanggürtel.** [Band Traps for Insects.]—*Zeitschr. f. Pflanzenkrankheiten, Stuttgart*, xxvi, no. 6–7, 16th September 1916, p. 444. (Abstract from *Prakt. Ratgeber. im Obst- u. Gartenbau*, 1915, pp. 188–189.) [Received 16th December 1916.]

A new band trap is described, made of cardboard, stamped with alternate vertical and horizontal, as well as circular, impressions. The larva of *Cydia pomonella*, L., prefers a horizontal shelter, while those of fruit-mining moths, such as *Lyonetia clerkella*, Hb., etc., prefer vertical ones.

Wolff (M.). **Ist** *Diestrammena marmorata*, **de Haan, ein Schädling?** [Is *Diestrammena marmorata*, de Haan, an injurious Insect?]—*Centralblatt f. Bakt., Parasit. u. Infektionskrankheiten, Jena*, IIte Abt., xlv, no. 6/12, 22nd April 1916, pp. 258–262. [Received 16th December 1916.]

The Orthopteron, *Diestrammena marmorata*, de Haan, which has been introduced into Germany partly direct from Japan and partly via Belgium, has been recorded by Reh and others as being occasionally very injurious. Investigations made by Boss in 1914 in hothouses at Thorn, West Prussia, where great damage had been done, have cast some doubt on this. Boss found that the older parts of plants were never attacked and that only in the observation cages were the young shoots injured, and this may have been due to the need for moisture. It is concluded that *D. marmorata* does not feed on plants, the injury ascribed to it being due to other less conspicuous insects. It may indeed be useful occasionally, as it feeds freely on millepedes and *Forficula* spp. Allied European species, which include *Troglophilus neglectus*, Krauss, *T. cavicola*, Koll., and *Saga serrata*, F., are all believed to be predaceous. *Decticus verrucivorus*, L., which was so named from the fact that the Swedish peasants utilised it to bite away warts on their skin, is a cannibal and will feed on cooked meat. The author has, however, also succeeded in feeding it on fir needles. *D. albifrons*, F., which occurs in all Mediterranean regions and in the Canary Islands, has been stated by Künckel d'Herculais to have caused enormous injury to vegetables and other crops when appearing in large numbers in Spain, Algeria and South Russia. The fact, however, that this species always occurred together with *Dociostaurus* (*Stauronotus*) *maroccanus* sheds some light on the data furnished by Fabre, who stated that in captivity *D. albifrons* preyed chiefly on small grasshoppers and locusts.

Béguet (M.). **Quatrième campagne contre les Acridiens** (*Schistocerca peregrina*, **Ol.) en Algérie au moyen du** *Coccobacillus acridiorum*, **d'Hérelle.** [The fourth Campaign against *Schistocerca peregrina* in Algeria by Means of *Coccobacillus acridiorum*.]—*Bull. Soc. Path. Exot., Paris*, ix, no. 9, 8th November 1916, pp. 679–682. [Received 1st December 1916.]

Acting on the conclusions arrived at by bacteriologists as to the value of *Coccobacillus acridiorum* as a means of destroying locusts,

practical application of the bacillus in large quantities was successfully carried out, the results being analogous to those obtained in the experimental campaign [see this *Review*, Ser. A, iv, p. 45]. Spraying with the virus of *C. acridiorum* invariably created an epizootic amongst the swarms of *Schistocerca peregrina*. In no case did this epizootic cause the complete disappearance of the infected swarm, but it was marked by a more or less considerable daily mortality. Where the ground had a uniformly level surface, the disease was disseminated, while it was centralised in broken ground affording the shelter of trees, hedges, etc. Infection is never carried for more than about 1 kilometre in the direction followed by the locusts, a swarm proceeding over uniform ground becoming immunised. It would appear, though this cannot be affirmed with certainty, that sprayed swarms cease to travel, and this occurs even where the incidence of the infection is inconsiderable.

VELU (H.). **La Lutte contre *Schistocerca peregrina* au Maroc en 1916 par la méthode biologique. Deuxième campagne d'expérimentation.** [Control of *Schistocerca peregrina* in Morocco in 1916 by the Biological Method. Second experimental Campaign.]—*Bull. Soc. Path. Exot., Paris,* ix. no. 9, 8th November 1916, pp. 682-684.

The experimental campaign of 1915 proved that *Schistocerca peregrina* could be most successfully controlled at the period when the locusts live in a compact mass and cannibalism is at its height [see this *Review*, Ser. A, iv, p. 46]. During 1916, practical experiments based on the conclusions reached were carried out. The first swarms of locusts arrived in November and December around Souss and Agadir and spread rapidly eastward, and more slowly northward, where climatic conditions are less favourable. By the end of July, the last swarms of the second generation had disappeared southwards. All swarms passing through Chaouia were attacked by a virulent *Coccobacillus*, the disease increasing under unfavourable climatic conditions. The conclusions were reached that it is impossible to increase the virulence of American stock *Coccobacillus*, preserved *in vitro* since the previous July, and that locusts hatched during the passage of contaminated swarms, are themselves contaminated. After May, the increase in virulence was normal. Spraying was carried out in various regions, 320 gallons being used of fresh mixture (24 to 36 hours) which caused death in six hours by inoculation in the laboratory. Results showed that the most favourable moment for contamination is the end of the 3rd instar, when the locusts form a compact mass. Contagion is then fatal and results in almost total destruction of the infected swarms From the 4th instar, the propagation of infection is much less certain; the columns are less dense, a greater distance is covered each day, while the diseased insects drop to the rear of the swarm and die isolated. Towards the last moult the swarms thus become largely freed from infected individuals; for this reason the last larval periods are not favourable to the application of this method, especially in open country. The ideal conditions for the application of d'Herelle's method are so difficult to obtain that it cannot be considered by itself a solution of the problem, although its economic value, when practicable, is undoubted.

Control of Peach Aphis.—*Agric. Gaz. N.S.W., Sydney,* **xx**vii, no. 11, November 1916. p. 778.

A simple and effective method of controlling the peach aphis is to wind a strip of sacking about two feet wide two or three times round the trunk of the tree from the ground-level upwards. A strip of flannel 6 or 9 inches wide saturated with equal parts of Stockholm tar and kerosene is then tied round the middle of the sacking. This should be done as soon as the flower buds begin to open, and the bandages should be left on till the leaves are well out and the fruit has set and grown to a fair size. The mixture must be renewed on the flannel once a week and must not touch the roots or bark of the tree. Experiments have however proved that this Aphid, besides wintering in the ground, leaves winter eggs under the bark or in the eyes on the upper part of the tree, so that this method is not entirely effective.

A Natural Enemy of the Lantana.—*Agric. Gaz. N.S.W., Sydney,* xxvii part 11, November 1916, p. 798.

Though the Agromyzid, known as the " lantana seed fly " has been introduced into Hawaii and has to a large extent prevented the spread of the weed, it has not been considered advisable to accede to various requests to introduce it into the North Coast of New South Wales, as the probability is that a fly that attacks lantana berries might also infest many of the common plants of Australia.

FROGGATT (W. W.). **A Descriptive Catalogue of the Scale Insects (" Coccidae ") of Australia.**—*Agric. Gaz. N.S.W., Sydney,* xxvii, no. 11, November 1916, pp. 809–816, 1 plate, 3 figs.

The following species are described :—*Pseudoripersia turgipes*, Msk., on *Casuarina suberosa* ; *Erium frenellae*, sp. n., on the desert cyprus, *Frenella robusta* ; *E. globosum*, Msk., on *Acacia armata* ; *Erium newmani*, sp. n., on an undetermined species of *Grevillea* ; *Pseudococcus* (*Dactylopius*) *acaciae*, Msk., on *Acacia linearis* and *Albizzia lophantha* ; *P.* (*D.*) *affinis*, Msk., on the roots of dahlias and potatoes ; *P.* (*D.*) *albizziae*, Msk., on *Albizzia lophantha* and several species of *Acacia* ; *P.* (*D.*) *aurilanatus*, Msk., on *Araucaria bidwilli* and *A. excelsa* ; *P.* (*D.*) *australiensis*, Gr. and Lidg., on *Acacia dealbata* ; and *P.* (*D.*) *bromeliae*, Bch., on pineapple, mulberry, canna and hibiscus.

DE BERGEVIN (E.). **Liste de quelques Hémiptères recueillis au Maroc.** [List of some Hemiptera collected in Morocco.]—*Bull. Soc. Hist. Nat. Afrique Nord, Algiers,* vii, no. 8, 15th November 1916, pp. 303–315.

This is a list giving the distribution of 122 species of Rhynchota in Morocco, without any particulars as to their economic importance.

TRINCHIERI (G.). **La Lutte contre les Sauterelles dans les divers Pays.** [Locust Control in different Countries.]—*Inst. Internat. Agric., Bureau des Renseignements Agricoles et des Maladies des Plantes, Rome,* 1916, **xvi** + 186 pp.

In the preface to this work, Dr. J. M. Saulnier, describes the circumstances which led to the compilation of this report by M. Trinchieri,

from information collected by means of a list of questions drawn up by the Bureau of Agricultural Intelligence and Plant Diseases and circularised throughout the world. He points out the necessity for concerted action against these insects, illustrating the futility of suppressing them in one district when the source of their origin is untouched. He reviews the different methods of control in vogue and compares their degrees of efficiency.

The report itself deals with the history and geographical distribution of locusts. A list is given of the harmful species observed in the different countries, comprising some 142 species, with the locality in which each occurs. This information is repeated in tabular form later in the report, when the food-plants are also given, as well as those plants avoided by locusts. A chapter is devoted to the biology and habits of locusts, and another to the organisation in force in each country for controlling them. The methods of control are classified under:—Natural enemies, mechanical, physical and chemical methods. Finally the question of an international understanding on the question of the control of locusts is discussed, and the following countries are given as approving of the principle of such an agreement:—Portugal, Spain, Italy, Austria, Hungary, Rumania, Greece, China, India, Morocco, Tunis, Kamerun, Canada, the United States, Mexico and Trinidad.

The report closes with a bibliography of several hundred references.

Desphande (V. G.) & Ramrao (S. K.). *Aphanus sordidus* **in the Konkan District (Bombay).**—*Poona Agric. Coll. Magazine,* vi, 1915, p. 200.

In the Konkan district of the Bombay Presidency ground-nuts (*Arachis hypogaea*) are attacked, both during and after the harvest, by the Lygaeid bug, *Aphanus sordidus*, which also infests *Sesamum* and *Carthamus tinctorius*. The attacks may be prevented by putting the nuts into thick sacks immediately they are gathered.

Watt (M. N.). **Contributions to the Entomology of New Zealand: no. 8.** *Parectopa citharoda,* **Meyr. (Order Lepidoptera).**—*Trans. and Proc. N. Z. Inst. for 1915, Wellington,* xlviii, 16th October 1916, pp. 407–413, 3 figs.

This article contains a description of *Parectopa citharoda*, Meyr., with an account of its life-history and of the mines which it makes in the leaves of the Australian broad- and narrow-leaved wattles (*Acacia pycnantha* and *A. saligna*). Its indigenous food-plants are unknown.

Brittin (G.). **Notes on some Coccidae in the Canterbury Museum, together with a Description of a New Species.**—*Trans. and Proc. N. Z. Inst. for the year 1915, Wellington,* xlviii, 16th October 1916, pp. 423–426.

The slides of Coccidae deposited by the late Mr. W. M. Maskell in the Canterbury Museum are discussed. The author considers that *Eriococcus multispinus*, Msk., and *E. pallidus*, Msk., are identical, the former name having priority. *Dactylopius poae*, Msk., was described from a damaged specimen of what appears to be a species of *Ripersia* and is possibly identical with *R. globatus*, Britt., which would

thus become a synonym of Maskell's species under the name of *R. poae*. *Mytilapsis drimydis*, Msk., is undoubtedly the second instar of a species of *Fiorinia*, probably *F. stricta*, Msk., now placed in the genus *Leucaspis* [see this *Review*, Ser. A, iv, p. 322]. A new Diaspidid is described under the name of *Odonaspis ? leptocarpi*, sp. n., occurring on *Leptocarpus* sp.

SPEYER (E. R.). **Spread of Insect Pests in Relation to the Agriculture of Ceylon.**—*Trop. Agric., Peradeniya*, xlvi, no. 4, April 1916, pp. 248–252. [**Received 21st December 1916.**]

This paper discusses the advisability of planting belts of trees of a kind immune from the attacks of the shot-hole borer of tea [*Xyleborus fornicatus*] and the tea tortrix [*Homona coffearia*], such as *Acacia decurrens*, between all tea-estates, as a means of checking further spread of these and other pests [see this *Review*, Ser. A, v, p. 51]. These belts should be 30 ft. wide, and should consist of closely-planted trees, supplemented by a thick undergrowth. This would be a large undertaking, involving considerable expense, but in the author's opinion is well worth consideration.

HENRY (G. M.). **Report of the Assistant Entomologist.**—*Trop. Agric., Peradeniya*, xlvii, no. 2, August 1916, pp. 94–100. [Received 21st December 1916.]

The information contained in this report relating to insect pests of tea, *Hevea*, coconuts and rice has already been abstracted [see this *Review*, Ser. A, v, p. 51]. Pests of fruit and vegetables included the Geometrid moth, *Thalassodes quadraria*, feeding on mango in August; the same plant was damaged by a leaf-miner and a leaf-roller in September, and by the Chrysomelid beetle *Monolepta orientalis*, Jac., in October. The scale, *Oudablis solani*, Green, infested egg-plants in April, and the lace-wing bug, *Urentius echinus*, Dist., attacked them in August; a shoot-borer of the same plant appeared in December, but could not be reared to maturity. It was probably the Pyralid, *Leucinodes orbonalis*. A Lepidopterous borer of potatoes was reported in September. An ant, *Dorylus indicus*, attacked rhubarb and turnips in March. The caterpillars of *Terias silhetana* defoliated *Sesbania grandiflora* in August. The larva of *Belippa laleana* appeared on *Gliricida maculata* in September. The Capsid bug, *Disphinctus formosus*, punctured guava leaves in October; this bug is allied to the *Helopeltis* which attack tea and cacao and does the same kind of damage. Citrus trees were attacked by a shot-hole borer, *Xyleborus* sp., in June, by an Aphid in November and by mites on the bark in December. Weevil larvae, probably those of *Odoiporus longicollis*, attacked plantains in November. The cigarette beetle, *Lasioderma serricorne*, was an important pest of dry tobacco. A small Trogositid beetle, which was also supposed to be attacking the tobacco, was shown experimentally to be predaceous on this beetle and on *Araecerus fasciculatus*.

Among green-manure plants, *Albizzia* was attacked by a scarlet mite in February, by *Xyleborus* in June and by *Terias silhetana* and *Arbela quadrinotata* in September. A mealy-bug attacked *Tephrosia candida*

in May, and later, being uncontrolled, also infested tea. The Pyralid moth, *Etiella zinckenella*, bored the pods of *Tephrosia candida* in October, and these were also attacked by *Araecerus fasciculatus* in December.

Dadap [*Erythrina*] was attacked by the paddle-legged bug (*Anoplocnemis phasiana*), *Terastia meticulosalis*, *Agathodes ostentalis*, *Dasychira horsfieldi* (?) and *Cyclopelta siccifolia*.

Ritchie (A. H.). **Crickets.**—*Jl. Jamaica Agric. Soc., Kingston*, **xx**, no. 6, June 1916, pp. 209–210. [Received 19th December 1916.]

Against the brown cricket, *Gryllus assimilis*, the application of wet red lead to the seeds before planting, or the use of poison baits in which syrup may be used instead of molasses, are advised. The following mixture is recommended :—Bran, 1 lb. ; Paris green, 1 oz. ; syrup, 3 oz. ; orange or lemon, $\frac{1}{4}$ fruit ; water, $1\frac{1}{2}$ pints.

An editorial note states that a thin coating of gas-tar to the seeds does not hinder germination, but that passing them through a mixture of kerosene oil and wood ashes is equally effective.

Insect Pests in Jamaica.—*Jl. Jamaica Agric. Soc., Kingston*, xx, no. 11, November 1916, pp. 432–435.

As the banana borer weevil [*Cosmopolites sordidus*] is apparently present throughout the irrigated area of St. Catherine, and has been found on areas which have hitherto produced 90 to 99 per cent. of bananas, the President of the Jamaica Agricultural Society considers that it would be a serious matter for the authorities to proceed on drastic lines unless more definite knowledge were obtained. The planters have done everything possible ; they have dug out infested roots and treated them with carbon bisulphide, but owing to the extent of the infestation, the carrying out of the orders of the Director of Agriculture with regard to control would result in great losses and the destruction of valuable plantations. Reports from Fiji show that the position there with regard to this borer is the same as in Jamaica, and experience points to the fact that the best means of preventing infestation is to keep the fields clean. Under these circumstances, the Governor has taken the responsibility of ordering the suspension of the orders of the Director of Agriculture, as far as St. Catherine is concerned.

Alfieri (M. A.). **Observations sur** *Sphenoptera trispinosa*, **Klug (Col. Buprestidae).** [Observations on *Sphenoptera trispinosa*, Klug.]—*Bull. Soc. Entom. d'Egypte, Cairo*, part 1, January-March 1916, pp. 15–16. [Received 27th December 1916.]

The larvae of *Sphenoptera trispinosa* are recorded as living in the base of the stems of *Sesbania aegyptiaca*, which is largely used by the natives for hedging their fields.

Alfieri (H. A.). **Les Parasites de la** *Sesbania aegyptiaca*, **Pers.** [The Insect Enemies of *Sesbania aegyptiaca*, Pers.]—*Bull. Soc. Entom. d'Egypte, Cairo*, part 1, January-March 1916, pp. 22–24. [Received 27th December 1916.]

The larva of *Lampides* (*Polyommatus*) *baetica*, L., attacks the flowers of *Sesbania aegyptiaca*. The enemies of this butterfly include the

wasp, *Eumenes gracilis*, Sauss., and various ants which destroy the pupae. The seeds of *Sesbania* in the pod are attacked by a Chalcid, *Eurytoma* sp., and by a species of *Bruchus*.

Gillette (C. P.) & Bragg (L. C.). **Two New Aphids, *Capitophorus shepherdiae* and *Siphocoryne aquatica*, (Hem., Hom.).**—*Entom. News, Philadelphia*, xxvii, no. 10, December 1916, pp. 445–448. 2 plates.

Descriptions are given of *Capitophorus shepherdiae*, sp. n., found on *Elaeagnus* and *Hippophaes*, on which it hibernates, and *Siphocoryne aquatica*, sp. n., which is common on the water-grass, *Catabrosa aquatica*.

Smith (L. B.). **Relationship between the Wetting Power Efficiency of Nicotine-Sulphate and Fish-Oil-Soap Sprays.**—*Jl. Agric. Research, Washington, D.C.*, vii, no. 9, 27th November 1916, pp. 389–399, 2 figs.

The author's experiments have demonstrated that the optimum efficiency of sprays containing nicotine sulphate and fish-oil soap was reached with a definite degree of concentration, while solutions of greater or less concentration were less effective as insecticides. The efficiency of the solutions was determined by field spraying experiments on peas, spinach and strawberries. A table is given showing the detailed results of these, divided into four groups. In group 1, a constant amount of nicotine sulphate was used throughout, fish-oil soap being added in varying quantities ; in group 4, fish-oil soap alone was used. The results indicate that the addition of nicotine sulphate to fish-oil soap solutions decidedly increases their value as insecticides, while the efficiency of nicotine sprays is also increased by the addition of soap, but when more than four pounds of soap were used with 10 oz. nicotine sulphate to 50 U.S. gals. of water, there was a loss of both wetting power and efficiency ; moreover, this loss of wetting power was not in direct ratio to the quantity of soap in the solution, and indications point to a chemical change taking place when a certain degree of concentration is reached, which affects the physical properties of the solutions containing nicotine, and also that the effect is greater after a definite degree of concentration of soap is reached. It is evident from the relative efficiency of the sprays that this chemical reaction affects the soap and not the active nicotine sulphate.

In groups 2 and 3 a constant amount of fish-oil soap was used with varying quantities of nicotine sulphate. The results showed that the addition of 5 lb. of soap to 50 gals. of nicotine solution increased the efficiency from 20 to 30 per cent. more than that of similar nicotine solutions which contained only 1 lb. of soap to 50 gals. of water. The most satisfactory results were obtained with formulae containing 5 lb. of soap, $6\frac{1}{2}$ to $8\frac{3}{4}$ oz. of nicotine sulphate and 50 gals. water ; when more than $8\frac{3}{4}$ oz. of nicotine were added, there was a loss in both wetting power and efficiency. While the quantities of soap in these solutions remained constant, there was a gradual loss of wetting power as the quantity of nicotine was increased. Thus the same results are arrived at as those produced by group 1. If nicotine sulphate is used

at the rate of 1 to 630, the optimum efficiency is obtained with 4 lb. of soap to 50 gals. water. By reducing the concentration of nicotine sulphate to 1 to 720, 5 lb. of soap to 50 gals. of solution gives the greater efficiency. The effect of loss of wetting power in a solution is indeterminable, since soap, as well as nicotine, has insecticidal properties. It has been found that insects thoroughly drenched with a solution show a much higher percentage of mortality than those struck by a few drops. Where the wetting power is affected, it is probable that the soap is also broken down sufficiently to lose some of its value as an insecticide ; hence, both factors must be considered as the cause of the loss of efficiency in the case of some of the more concentrated mixtures.

HORTON (J. R.). **Some Weatherproof Bands for Use against Ants.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* v, no. 11, November 1916, pp. 419–421.

This circular gives the best formulae for preparing lasting banding mixtures arrived at in the course of a long series of experiments in which some twenty combinations were tried. While great improvement can be made in the adhesive bands by varying their consistency, so as to keep them soft in all kinds of weather in which the ants are active, the fact remains that they will gradually collect rubbish and dust until they become ineffective. A mixture of corrosive sublimate, one part of sublimate to six parts of tree-sticky, was tried and proved successful, in that no ants crossed it and no spreading or renewal was needed for about three months. When the ants finally did begin crossing the band on the accumulated rubbish they were only able to cross very slowly, and plainly showed effects of poisoning from the mercuric salt. As however this material is extremely injurious to the bark of trees, if it comes in contact with it, it was replaced by flowers of sulphur, one part by weight to six parts by weight of tree-sticky, with equally satisfactory results. The tree trunk should first be wound round with tape and the mixture laid on that, as if laid directly on the tree it is likely to be absorbed and cause injury in course of time. The bands should be from four to six inches wide and about one quarter of an inch thick. Another fairly satisfactory mixture is composed of one part by weight of ordinary black axle grease and two or three parts of commercial tree-sticky, thoroughly stirred with a wooden paddle until a uniform mixture results. Bands of this mixture have remained effective for about two months. It should not be allowed to come into direct contact with the tree bark for long periods of time. The " ant tape " of commerce, made by soaking strips of cotton cloth in a saturated water solution of corrosive sublimate, is useless out of doors, as it cannot withstand moisture and is a source of danger to children and domestic animals. The following method of preparing it, however, overcomes both these difficulties. Corrosive sublimate, 20 grammes, dissolved in 60 cc. of ethyl alcohol and 31 grammes of orange or white shellac added to the solution, are shaken at intervals in a bottle until liquified. The mixture may then be applied with a paint brush to the legs of tables or refrigerators or to the supports of beehives. It dries perfectly hard in a few minutes, is absolutely waterproof, and will remain effective for more than a year on wood, but is more rapidly

exhausted if applied to metals. Such articles should be placed on wooden blocks previously painted with the above mixture. Further experiments are being made on the use of this mixture on trees, but the results of the few tests made have been so far satisfactory, except when applied directly to the bark, when the effect was disastrous. Owing to the high price of alcohol this method is not likely to be used to a great extent. The substitution of methyl alcohol for ethyl is not recommended, as it appears to destroy the repellent effect of the mercuric salt.

MASKEW (F.). **Quarantine Division ; Report for the Month of September 1916.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* v, no. 11, November 1916, pp. 422–423.

The following pests were intercepted during September :—From Central America : *Aspidiotus cyanophylli* and *Pseudococcus* sp. on bananas. From China : *Cylas formicarius* in sweet potatoes. From Hawaii : *Diaspis bromeliae* and *Pseudococcus bromeliae* on pineapples ; *Coccus longulus* on betel leaves. From Japan : a Coccid on the fruit of pears ; *Cladosporium citri* on lemons ; *Pseudococcus,* sp. n., on a pot plant. From Mexico : *Pseudococcus* sp. on green coconuts ; *Chionaspis* sp. on coconuts ; *Lepidosaphes gloveri* on limes. From Nevada : *Chortophila* (*Phorbia*) *planipalpis* in a vegetable resembling mustard plant. From Tahiti : *Morganella maskelli* and *Lepidosaphes beckii* on oranges and limes. From New York : *Pseudococcus* sp. on rose plant. From Michigan : *Cydia pomonella* in apples. From Ohio : an undetermined scale on ornamental plants. From Pennsylvania : *Pseudococcus nipae* on rose.

LEACH (B. R.). **The Apple Leaf-sewer.**—*U.S. Dept. Agric., Washington, D.C.,* Bull. no. 435, 25th November 1916, 16 pp., 6 figs., 1 plate, 5 tables.

The apple leaf-sewer, *Ancylis nubeculana,* was common at Winchester, Virginia, in the summer of 1914. The larva of this moth may do considerable damage to the foliage of apples, especially in young orchards receiving indifferent care. It is generally distributed over the North and Central Atlantic States, the Middle West, and in portions of Canada, and appears to confine its attack to the apple.

The feeding habits, method of folding the leaf, and life-history of *A. nubeculana* are given and are summarised by means of tables. The larva hibernates inside the fold of the leaf and is able to withstand great extremes of moisture and temperature.

The larvae are attacked by a number of parasitic and predaceous enemies, of which the Chalcid, *Pseudomphale ancylae,* Gir., is very common. A Braconid, *Rhysipolis phoxopteridis,* Riley, and an Ichneumonid, *Angitia paediscae,* Riley, have also been reared from the larvae, while ants are an important factor in reducing the number of larvae and pupae during winter and spring.

The control of this moth with arsenical sprays is rendered s'mple, owing to the fact that the larva migrates from one leaf to another several times during the season. As the eggs begin to hatch about 14th June and continue to do so until about 2nd July, the regulation arsenical spray of 2 lb. arsenate of lead to 50 U.S. ($42\frac{1}{2}$ Imp.) gals. of

water, applied by 15th June, will therefore control it. Where the second spray for the first brood of codling moth [*Cydia pomonella*] is usually applied by this date, no special application will be required. Young orchards should receive the arsenical spray as soon as this pest appears in numbers sufficient to cause any serious damage. Lime-sulphur solutions or Bordeaux mixture may be added if required.

The bulletin closes with a bibliography of 13 references.

Un Insecte nuisible aux Poiriers et aux Cerisiers. [An Insect harmful to Pear and Cherry Trees.]—*La Vie Agric. et Rur., Paris,* vi, no. 51, 16th December 1916, p. 454.

To control *Eriocampoides limacina* the foliage should be dusted with newly slaked lime. For cherry trees in orchards, arsenical sprays may be used as soon as the gathering of the fruit is over. Trees which are attacked need stimulating to counteract the ravages of the insect, and the application of fertilisers to the soil is therefore advised. The following mixture may be dug in round the roots of the trees in the proportion of $4\frac{1}{4}$ oz. superphosphate, $1\frac{1}{2}$ oz. potassium sulphate and $1\frac{3}{4}$ oz. ammonium sulphate to every square yard, or a liquid manure may be applied.

French Junr. (C.). **Insect Pests of the Fruit, Flower and Vegetable Garden.**—*Jl. Dept. Agric. Victoria, Melbourne,* xiv, nos. 4, 5, 7, 8, 10; pp. 213–218, 314–317, 433–438, 495–498, 604–611; 27 figs..

The pests dealt with here, include:—*Eriosoma lanigerum* (woolly aphis), *Cydia pomonella* (codling moth), and *Cacoecia responsana* (light brown apple moth), of which the two last-named are very destructive to apples and are controlled by lead arsenate sprays; *Tetranychus telarius* (red spider) found on all fruit, vegetable and garden plants, which can be controlled by tobacco water in summer and red oil in winter. *Nysius vinitor* (Rutherglen bug) severely damages peaches, apricots and tomatoes, but fortunately only appears in vast numbers once in about 10 years and should be checked by benzole emulsion or tobacco sprays; smudge fires sprinkled with sulphur are also a successful remedy. A good spray consists of 1 quart phenyle, 3 lb. washing soda, and 1 bar yellow soap, dissolved in 40 gallons of hot water.

Myzus sp. (green peach aphis) should be checked by lime-sulphur wash or red oil, while the trees are dormant; the Scarabaeid, *Diphucephala colaspidoides,* Gyll. (cherry green beetle), originally a tea pest, now attacks many fruits and garden plants. Smudge fires should be tried, and trees sprayed with arsenate of lead before the fruit ripens.

Icerya purchasi, Msk. (cottony-cushion scale) is a well-known pest on orange, lemon, acacia, and other trees and plants. Red oil, lime-sulphur and kerosene emulsion sprays are used as controls. *Aspidiotus hederae,* Vall., (*nerii,* Bch.), is a common greenhouse and garden pest, against which red oil and lime-sulphur are used. *Metura elongata,* Saunders (case moth) is controlled by arsenical sprays, Paris green or arsenate of lead. *Phalaenoides* (*Agarista*) *glycina,* Lewin (vine moth) increases very rapidly on vines, and should be sprayed with arsenate of lead. *Heliothis obsoleta,* F. (*armigera,* Hb.)

(tomato moth) deposits eggs on the fruit, and as soon as the young emerge, they bore into the tomato and eat the inside out. Poison baits can be used, made of bran, 10 lb., molasses, 4 lb., Paris green, 4 oz.; this mixture, made into a paste, should be spread about in small pieces amongst the fruit and will also destroy quantities of the cutworms, *Persectania* (*Mamestra*) *ewingi* and *Agrotis* sp., which abound in gardens. The Lymantrid, *Teia anartoides*, Walk., attacks apples, quinces, plums and garden plants; hessian bands have been found successful, and arsenical sprays are also efficacious. Against *Antherea eucalypti*, Scott (gum emperor moth), which attacks pepper and eucalyptus trees as well as apples and roses, arsenical sprays should be used. *Pseudococcus albizziae*, Msk. (dark purple wattle scale) is found on all wattles and is now beginning to attack oranges; kerosene emulsion and red oil are used as remedies. The caterpillars of *Zizera labradus*, Godt. (bean butterfly) bore into bean-pods and eat the young beans; sprays of lead arsenate should be used. *Aulacophora hi aris*, Boisd. (pumpkin beetle), besides damaging Cucurbitaceous plants, now attacks peaches, nectarines, cherries, apples, etc. Arsenate of lead, hellebore, Paris green and kerosene emulsion make good sprays. A good mixture is 1 part kerosene oil, 1 part sour milk, and 100 parts water. Crude oil of tar can be used, one gallon making 80 gallons of spray. Dusting the plants with air-slaked lime has proved effectual. The Limacodid, *Doratifera vulnerans*, Lewin (mottled cup moth) feeds on peppermint and eucalyptus and also attacks apples and cherries. Arsenical sprays, Paris green, or arsenate of lead will kill this pest. *Lonchaea splendida* (metallic tomato fly) should be sprayed with quassia chips and benzole emulsion. The Arctiid moths, *Diacrisia canescens*, Le G., and *Ardices glatignyi*, Butl., attack flowering plants and vegetables, especially beans, and can be controlled by arsenate of lead sprays. *Thrips tabaci*, Lind., attacks potato crops severely as well as fruit trees; the latter should be sprayed when in bud with benzole emulsion or coal-tar water, made by boiling 1 lb. coal tar in 2 gals. rain water and adding, while hot, 50 to 100 gals. of water. Nicotine, lime-sulphur, hellebore and quassia sprays are all recommended. Smudge fires may also be tried. *Desiantha nociva*, Lea (tomato weevil) works havoc among tomatoes. Arsenate of lead gives the best results. A good plan is to place sheets of newspaper under the leaves at night and then approach with a light, when the beetles are startled and fall on to the paper. Rose and raspberry scale should be treated with prepared red oil, or kerosene or benzole emulsion. *Eriococcus coriaceus*, Msk. (gum scale) rarely attacks fruit trees, but is found on young eucalyptus and other trees. Red oil spray and kerosene emulsion are recommended against it. *Eulecanium* (*Lecanium*) *berberidis*, Sch. (vine scale) is increasing on Australian vines, and has lately been found on plums, apricots and other trees. Loose bark should be scraped from vines and plants should be sprayed with red oil or benzole emulsion. Against the rose aphis the sprays recommended are tobacco water, quassia chips and soft soap, benzole emulsion, surpazol, Niqua's pine spray, and best of all, red oil used after pruning. The apple-root borer [*Leptops*] is difficult to deal with, the larvae living deep in the soil and roots of the trees. Spraying with arsenate of lead and trapping the weevils have been fairly successful, but further experiments are at present being carried out.

Ballou (H. A.). **Report on the Prevalence of some Pests and Diseases in the West Indies during 1915, Part I, Insect Pests.**—*West Indian Bull., Barbados*, xvi, no. 1, 1916, pp. 1–30. [Received 22nd December 1916.]

This report is compiled from the reports of the principal agricultural officers. The entomologist visited Grenada in February and March to study the conditions which influence the outbreaks of the cacao thrips, *Heliothrips rubrocinctus* [see this *Review*, Ser. A, iii, p. 582].

The following insect pests are recorded :—On sugar-cane : *Diatraea saccharalis* (moth borer), *Metamasius* (*Sphenophorus*) *sericeus* (weevil borer), *Diaprepes* (*Exophthalmus*) *esuriens* (root borer), *Lachnosterna patruelis*, *Ligyrus tumulosus* and *Strategus titanus* (hard back grubs), and termites.

On cotton : *Alabama argillacea* (cotton worm), *Heliothis obsoleta* (boll worm), cotton stainers, *Saissetia nigra* (black scale), *Hemichionaspis minor* (white scale), *Contarinia gossypii* (flower-bud maggot), *Eriophyes gossypii* (leaf blister mite), *Colaspis fastidiosa* (bronze beetle), *Periplaneta australasiae* (common cockroach) and *Gryllus assimilis* (common field cricket).

On cacao : *Heliothrips rubrocinctus*, *Steirastoma depressum*, scale-insects, termites, and the acrobat ant [*Cremastogaster* sp].

On citrus : *Coccus viridis* (green scale), *Lepidosaphes beckii* (purple scale), *Chionaspis citri* (white scale), *Leptostylus praemorsus* (bark borer), *Elaphidion mite* (twig borer), *Diaprepes*, *Lachnopus* spp. and grasshoppers.

On sweet potatoes : *Euscepes* (*Cryptorrhynchus*) *batatae* (scarabee), *Protoparce cingulata*, and *Tetranychus telarius* (red spider).

On ground-nuts : Scale-insects, woolly pyrol moth [*Anticarsia gemmatalis*], and *Diaprepes esuriens*.

On coconuts : *Aleurodicus cocois* (whitefly), *Aspidiotus destructor*, and *Rhynchophorus palmarum*.

On maize : *H. obsoleta* (corn-ear worm), *Laphygma frugiperda*, *Lachnosterna patruelis*, *Diatraea saccharalis*, Aphids and a Geometrid caterpillar.

On onions : *Prodenia* sp. and *Thrips tabaci*.

On yams : *Aspidiotus hartii*.

Miscellaneous pests included :—*Anticarsia gemmatalis*, *Cryptorrhyncus* sp. [*Styracopus phaseoli*, Mshl.] and *Eudamus proteus* on lima beans, *Calpodes ethlius* (arrowroot worm), and the Longicorn, *Batocera rubus*, on mango, avocado pear, papaw, banana, hog plum, *Ficus* and *Ochroma lagopus*.

The natural enemies of injurious insects include a predaceous thrips attacking the eggs of the cotton stainer, *Dysdercus delauneyi* ; *Prophanurus alecto* parasitising the eggs of *Diatraea saccharalis* ; *Polistes crinitus* and *P. annularis*.

A table showing the distribution of these insect pests in the various islands is appended.

Harland (S. C.). **Notes on Resistance to Cotton-leaf Blister Mite with special Reference to Budded Cottons and to Cotton Hybrids.** —*West Indian Bull., Barbados*, xvi, no. 1, 1916, pp. 78–82.

The leaf blister mite, *Eriophyes gossypii*, Bks., attacks all parts of

the cotton plant except the roots, forming blisters which are lined with a thick growth of very fine hairs, among which the mites live.

The West Indian native cottons may be divided into two groups, those immune to this mite and those which may be attacked by it, but which are fairly resistant as compared with the very susceptible sea-island cotton. In general it may be said that the nearer an indigenous cotton approaches that variety in morphological characters, the more susceptible it becomes.

With regard to budded cottons the only scion which remained immune was one that was budded on to the susceptible sea-island stock. When a susceptible scion was budded on to immune stock, the resistance was apparently increased, but when the stock was fairly resistant and the scion susceptible, or vice versa, the susceptibility or resistance of the scion remained unchanged.

In the case of hybrids the F/1 of the cross " immune " by " susceptible " is almost immune when sea-island is the susceptible parent, but when upland cotton is used as the susceptible parent, the F/1 is also susceptible. The F/1 of the cross " susceptible " by " susceptible " is susceptible; as is also the case when " susceptible " is crossed with " fairly resistant."

ANDERSON (T. J.). **Report on the Entomological Laboratory for the Year ending 31st March 1914.**—*Ann. Rept. Dept. Agric. British East Africa, 1913–1914, Nairobi,* 1915, pp. 52–83. [Received 27th December 1916.]

The coconut beetle (*Oryctes monoceros*, Ol.) is the worst enemy of coconut palms on the coast of British East Africa. Experiments were made in its control by means of traps consisting of heaps of decaying vegetable matter to which the beetles are attracted for egg-laying. A hole was dug in the ground about 9 feet square and about 18 inches deep, and filled with parts of stems of palms and other vegetable matter. For filling the traps numbers of dead palms were split up and the various stages of the beetle they contained collected, counted and destroyed. A detailed record of the first 1,000 palms cut shows that both standing and fallen dead palms are breeding grounds for the beetles, and therefore their destruction is essential. A list of the beetles, etc., found in 186 of the traps $4\frac{1}{2}$ to 5 months after construction is also appended. No more traps will be constructed at present, but those already made will be examined regularly to find out if they become more effective with age, and if so, whether other breeding places are thus eliminated. All traps are being made under Government supervision or on the plantations owned by Europeans, as even the better class native cannot be trusted to carry out the work satisfactorily unless supervised. A species of *Aspidiotus* was reported to be doing considerable damage to young palms near Mombasa. A resin and washing soda spray was suggested against it and gave satisfactory results.

Papilio demodocus, Esp. (the citrus butterfly) occurs wherever citrus fruits are grown in the Protectorate, but nowhere in very large numbers. The caterpillar is parasitised to some extent by an Ichneumon and was controlled by a spray of arsenate of lead to which a small quantity of soft soap and gelatine was added. This increased the wetting power

of the liquid, and the adhesiveness of the poison on the leaf surface. The spray remained effective for many months. Hand-picking of caterpillars on young stocks in a nursery is often necessary. A small Pyralid [probably the Tortricid, *Argyroploce leucotreta*, Meyr.] is the most serious pest of citrus so far met with, but at present seems to be confined to Nairobi and the neighbourhood. The habits and life-history of this moth are given. Attacked fruit, which usually falls prematurely, should be destroyed at once or buried in a deep pit. Constant raking over and cultivation beneath the trees will destroy many pupae. *Icerya purchasi*, Msk. (the cottony cushion scale) occurs in one district. A scale closely resembling *Chrysomphalus aurantii*, Msk., has been found on young imported stock, and *Vinsonia stellifera*, Westwood, occurs in small numbers. The citrus psylla occurs everywhere and, in connection with Aphids, may considerably distort young growing shoots and generally injure the growth of the tree. Gathering the pitted leaves and those carrying the numerous eggs and burning them helps to control this pest. The common Aphid on citrus is *Aphis tavaresi*, Del G. (the black citrus aphis), which occurs generally throughout the Protectorate. It is believed that heavy showers of rain help to keep this insect in check. It is very irregular in its occurrence, appearing suddenly and multiplying rapidly and then disappearing. Only a few parasitised individuals have been found. *Toxoptera aurantii*, Boy., has also been recorded from several localities. An unidentified species of small red mite has been found on citrus trees. Powdered sulphur is effective against it, but the maintenance of healthy soil conditions, irrigation if necessary, and the removal of all fruit after the fruiting season is over, are better methods of control.

The following scale and other insects have been found on coffee :– *Coccus* (*Lecanium*) *viridis africanus*, Newst., controlled in dull weather with a 10 per cent. kerosene spray and a 5 per cent. spray during bright weather, *Saissetia* (*L.*) *hemisphaerica*, Targ., *S.* (*L.*) *nigra*, Niet., *Pulvinaria psidii*, Msk., and cutworms, of which *Euxoa segetum*, Schiff., and *Polia inferior*, Gn., appear to be the two commonest. *Antestia variegata* (coffee bug) seems to be on the increase. Hand collecting is the best control method available. Specimens of the cabbage bug, *Bagrada picta*, have also been found on coffee. The moth, *Leucoptera* (*Cemiostoma*) *coffeella*, is not regarded as serious, but needs to be watched. *Thliptoceras octoguttalis*, Feld. (the coffee moth) is not a serious pest, but has a wide distribution. *Apate monacha*, F., has been recorded in several places, but the true coffee borers, such as *Anthores leuconotus*, have not been found in any of the recognised coffee areas. Cockchafers (*Schizonycha*, *Anomala*, etc.) have caused damage in some plantations. The Tenebrionid, *Gonocephalum contractum*, has been reported from one plantation.

Eriosoma lanigerum (the woolly aphis) occurs on apple in some districts. The Coccinellids, *Exochomus flavipes* and *Hippodamia variegata*, were found on infested trees apparently feeding on the Aphids. Another Coccinellid, *Chilocorus distigma*, Kl., feeds on a scale on apples believed to be a species of *Diaspis*. The Cetoniid beetle, *Oxythyrea elegans*, Kl., feeds on the blossom, but is not a serious pest. *Orgyia vetusta*, Hmp., the quince moth, attacks quince trees and is also recorded from apple and black wattle.

The wattle bug and hopper is the most serious pest recorded on wattle. *Mylabris distincta* occurs on beans, *Heliothis obsoleta*, F., and an undetermined stem borer on maize, while *Macrosiphum granarium*, Kirby, and *Aphis africana*, Theo., are the common Aphids on broom-corn.

ANDERSON (T. J.). **Report of the Entomological Laboratory for the Year ending 31st March 1915.**—*Ann. Rept. Dept. Agric. British East Africa, 1914–1915, Nairobi*, [n. d.], pp. 38–54. [Received 27th December 1916.]

This report does not deal with individual crops but gives a useful list of the insects of economic importance in the Protectorate, so far as they are yet known, with their distribution and food-plants.

ADAMS (J.), **Report of the Agricultural Instructor for the Year ending 31st March 1915.**—*Ann. Rept. Dept. Agric. British East Africa, 1914–1915, Nairobi*, [n. d.], pp. 80–83. [Received 27th December 1916.]

The pests noticed during the year, were :—Aphids, *Lepidosaphes ulmi* (*Mytilapsis pomorum*) on apples, mildew on grapes and fruit-fly in plums and peaches.

LAMB (P. H.). **Plant Pests.**—*Rept. Agric. Dept. Northern Provinces, Nigeria, for the Year 1915, Lagos*, 1916, p. 13.

The only serious insect pest encountered has been the mole-cricket, *Gryllotalpa africana*, which feeds voraciously at night and, if unchecked, will within a very short time completely devour whole beds of young seedlings. It has been systematically dealt with by digging out or flooding the burrows. These crickets are most troublesome during the earlier part of the year, when succulent food is scarce.

JOHNSON (W. H.). **Entomology.**—*Ann. Rept. Agric. Dept. Southern Provinces, Nigeria, for the Year 1915, Lagos*, 8th May 1916, p. 8.

Coconuts, yams, and bananas have been attacked by *Aspidiotus destructor*. The flowers of ground-nuts were injured by the Meloid beetle, *Decatoma affinis*. Serious damage was avoided by collecting the pest by hand. Cacao was frequently injured by the bark-sapper bug, *Sahlbergella theobroma*, Dist.

MCKILLOP (H. T.) & GOUGH (L. H.). **Report on the Great Invasion of Locusts in Egypt in 1915, and the Measures adopted to deal with it.** —*Ministry of Agriculture, Cairo*, 1916, X + 72 pp., 7 appendices, 2 diagrams, 6 maps, 7 plates.

This report contains a review of the recent invasions of locusts into Egypt. Both in 1914 and 1915 the locusts came from the west and the east and their arrival in the Nile Valley was dependent on weather conditions. With regard to their destruction it was found that for

Egyptian conditions the best method consists of driving the locusts into small trenches and burying them. Contact insecticides are useful, but are not as effective as the above method. Control by means of *Coccobacillus acridiorum* and internal poisons is of little avail in this climate. As no locust swarms arrived at maturity in Egypt, the damage done was very small. Where it was appreciable, it was usually due to indifference or negligence on the part of the owners, and it has been found that Government supervision is absolutely necessary for the control of locusts.

The total cost of the campaign was about £17,000, and in spite of the fact that the locusts appeared in practically every part of Egypt, the cotton crop, although in great danger, was almost entirely saved.

The appendices deal with the ministerial orders relating to the destruction of locusts, the quantities of locusts and egg-masses collected from the various areas up to the end of the campaign, and some reprints from former papers on this subject.

Les Essais de traitements contre la *Cochylis* **en Suisse.** [Experimental Treatments against *Clysia ambiguella* in Switzerland.]—*La Vie Agricole et Rurale, Paris,* vi, no. 52, 23rd December 1916, p. 470.

The results of experiments carried out at the Lausanne Station show that solutions of titrated nicotine and concentrated tobacco juice are effective if carried out at the right moment, that is, a few days after the full flight of the moths. This is about three weeks after the appearance of the first moths.

Another solution that has given excellent results is based on black soap and pyrethrum powder.

Siegler (E. H.) **A Codling Moth Trap.**—*Jl. Econ. Entom., Concord, N.H.*, ix, no. 6, December 1916, pp. 517–521, 1 plate.

In the Grand Valley of Colorado, spraying has proved quite ineffectual as the sole means of controlling *Cydia* (*Carpocapsa*) *pomonella*, L., and has also become too expensive to compensate for the benefits derived from it. The more successful growers resort to a combination of spraying and banding; the need for banding is shown by an example of twenty banded trees which yielded over 4,000 larvae after having been sprayed eight times. The objection to banding is the labour and expense involved in gathering the larvae about eight times each season. The author has therefore devised a trap which will probably last two or three years, costs about 1*d.* per trap, and requires attention only at the beginning of each year. This is composed of a twelve-mesh wire-screen cloth six inches wide and long enough to encircle the tree. The edges are crimped in order to fit closely to the tree, without tearing, when attached. The trunk is first banded with burlap about 2 inches wide and the wire-screen tacked round over the band. No moths can escape the mesh and it has been found that the larvae readily enter the trap. Throughout the season, the emergence of the moths in the traps will serve as a guide for timing the spray applications. It is hoped that the pest may be effectively controlled by thorough and timely spraying, supplemented by the use of this trap.

Watson (J. R.). **Life-History of the Velvet-Bean Caterpillar** (*Anticarsia gemmatalis*, **Hb.**).—*Jl. Econ. Entom., Concord, N.H.*, ix, no. 6, December 1916, pp. 521–528, 2 pl., 2 figs.

This paper is an amplification of an earlier one [see this *Review*, Ser. A, iv, p. 37]. A description of the life-history, habits and distribution of this moth is given. Besides *Stizolobium* sp. (velvet bean), which is the preferred food-plant, *Pueraria thunbergiana* (Kudzu vine) and *Canavalia* sp. (horse bean) are also attacked. Many predaceous enemies attack *Anticarsia gemmatalis*, including *Agelaius phoeniceus* (red-winged blackbird), lizards, wasps, the Carabid, *Callida decora*, and the bugs, *Alcoeorrhynchus grandis*, Dall., *Brochymena annulata*, F., *Euthyrhynchus floridensis*, L., and *Podisus maculiventris*, Say. Internal parasites are rare, only two, the Tachinid, *Euphorocera floridensis*, and the Ichneumonid, *Itoplectis rufuscula*, Davis, having been obtained from many hundred pupae. By far the most important enemy of this insect is the fungus, *Botrytis rileyi*, which holds it in check during September and October, thus reducing the need for arsenicals.

Graham (S. A.). **Notes on the Control of the White Pine Weevil.**—*Jl. Econ. Entom., Concord, N.H.*, ix, no. 6, December 1916, pp. 549–551.

This is a record of experiments with various sprays for the control of *Pissodes strobi*, Peck., on the white pine. These included kerosene, creosote, carbolineum, sulphur, lead arsenates, calite and carbolic. The only effective sprays were creosote and carbolineum, but with each of these there is some injury to the tree, and further experiments are required. It is necessary to spray only the terminal shoots, as these are the points attacked. The application of tanglefoot to the trees is also considered worthy of further experiment.

Hungerford (H. B.). *Sciara* **Maggots Injurious to Potted Plants.**—*Jl. Econ. Entom., Concord, N.H.*, ix, no. 6, December 1916, pp. 538–549, plates.

The larvae of the Mycetophilid, *Sciara coprophila*, are omnivorous feeders, their favourite food being the roots and root-hairs of potted plants. The life-history, which is fully described, occupies 24 to 32 days. The insect prefers soils that are moist and rich in manure. All kinds of insecticides were tried against the maggots in the soil, but the most effective measure was to let the soil become perfectly dry occasionally. Dry sand should be laid on the surface of the soil, and trap-pots of dried blood and earth and sprouting grain will attract the ovipositing adults. These traps should be submerged in boiling water about every two weeks to destroy the eggs. The maggots are attacked by a Dipterous parasite [see this *Review*, Ser. A, iii, p. 466]; a bug, *Milyas* sp., destroys the eggs, and there is also a Nematode parasite, the life-history of which is being studied.

A bibliography of 23 works is given.

Sell (R. A.). **Notes on the Twelve-spotted Cucumber Beetle.**—*Jl. Econ. Entom., Concord, N.H.*, ix, no. 6, December 1916, pp. 551–556.

Diabrotica duodecimpunctata, Ol., is increasing in Texas and from April to June is found on many fruits, vegetables, garden and wild flowers. Experiments show that these beetles are capable of adaptation to change of diet. Hibernation experiments were inconclusive; the adult can be found throughout the winter on the coffee bean (*Daubentonia longifolia*) in sheltered spots in woods and, when kept under artificial conditions, was not observed to hibernate. Dr. Huxley has suggested that material may be stored up in the bodies of the insects, thus obviating the necessity for hibernation under certain conditions. Flight experiments seem to show that there is a decided gain in endurance on the wing corresponding to the length of a period of fasting, and it seems possible that the insect prepares for winter by storing tissue that is available for migration in localities where hibernation is not necessary. Fasting can be endured much longer if the insects are kept violently exercised, and beetles exercised until fatigued almost every day without food, were much more lively than those kept in cages with abundance of food. An attempt was made to study the field-habits in July, but marked beetles disappeared rapidly and very few were seen again.

McGregor (E. A.). **The Privet Mite in the South.**—*Jl. Econ. Entom., Concord, N.H.*, ix, no. 6, December 1916, pp. 556–561.

Tenuipalpus bioculatus, McG. [see this *Review*, Ser. A, iii, p. 306] has been found abundantly in the south-eastern States, and is not by any means confined to privet (*Ligustrum* spp.), although it shows a decided preference for this plant, which often succumbs to its attacks. A full description of the various stages and life-history of this mite are given. As in previous experiments, lime-sulphur was found to be the best insecticide against it.

Dutcher (R. A.). **Some Effects of freezing Arsenate of Lead Pastes.**—*Jl. Econ. Entom., Concord, N.H.*, ix, no. 6, December 1916, pp. 561–566, 2 plates.

In the course of some preliminary experiments the settling properties of some commercial samples of lead arsenate paste were found to be affected by freezing, while others were not. The microscopic appearance of all the pastes examined was altered and their adhesive properties may be affected, but what influence this would have on their use in sprays is unknown. Further experiments in this connection are to be made.

Wheeler (W. M.). **An Indian Ant introduced into the United States.**—*Jl. Econ. Entom., Concord, N.H.*, ix, no, 6. December 1916, pp. 566–569, 1 pl., 1 fig.

The common Indian ant, *Triglyphothrix striatidens*, Emery, has recently spread into the United States. This ant, of which a description is given, is very liable to be imported with tropical plants. A bibliography of 15 works is appended.

Holloway (T. E.). **Moving Lights versus Stationary Lights in Phototropism Experiments.**—*Jl. Econ. Entom., Concord, N.H.*, ix, no. 6, December 1916, pp. 570–571.

It is considered probable that moths are more readily attracted by a moving light than by a stationary one. While stationary lights of various colours and intensities have failed to attract them, large numbers of *Diatraea saccharalis* and *Laphygma frugiperda*, especially the gravid females, have been found to come to a light carried round the edge of a sugar plantation on a truck, on which was mounted a gasoline engine producing a suction of air powerful enough to kill or maim all insects attracted within its range. The experiments are however inconclusive, as the noise and disturbance caused by the passage of the engine may have induced more insects to take wing than a light only would have done.

Chittenden (F. H.). **On the Distribution of the Imported Cabbage and Onion Maggots.**—*Jl. Econ. Entom., Concord, N.H.*, ix, no. 6, December 1916, p. 571.

The true cabbage maggot, *Chortophila* (*Pegomyia*) *brassicae*, Bch., and the onion maggot, *Hylemyia antiqua*, Mg. (*P. cepetorum*, Meade), have erroneously been reported by many entomologists from Texas and other Gulf States, whereas, in the author's opinion, these species do not occur, permanently at least, south of New Jersey. From that point southward they are replaced by the seed-corn maggot, *Chortophila* (*Pegomyia*) *fusciceps*, Zett.

Wilson (T.). **The Cottony Maple-scale** (*Pulvinaria innumerabilis*).—*Proc. B. C. Entom. Soc., Victoria,* 1916, Entom. Series no. 9, August 1916, pp. 57–59. [Received 3rd January 1917.]

This scale is increasing rapidly in British Columbia and has been found on a great variety of food-plants, such as thorns, poplars, grape-vines, willows, gooseberries, and the maples, *Acer glabra* and *Acer negundo*. It is first noticed after the females have attained their full growth in May or June and have excreted a quantity of a cotton-like substance. The young scales mainly attach themselves to the under-side of the leaves, the first moult taking place about a month after the young leave their mother. A lime and sulphur spray at winter strength, with the addition of caustic soda, should be used after the leaves have fallen and will thoroughly dissolve the scales. They may also be checked by a strong water spray from a hose.

Treherne (R. C.). **The Pea-weevil in British Columbia.**—*Proc. B. C. Entom. Soc., Victoria,* 1916, Entom. Series no. 9. August 1916, pp. 59–60. [Received 3rd January 1917.]

A warning is given to growers in British Columbia against the importation of *Bruchus pisorum*, L., in infested seed-peas from the United States or elsewhere, as this insect has been found in consignments to the Province, which is at present free from it.

Hamilton (J. A.). **Entomology in the Public School.**—*Proc. B. C. Entom. Soc., Victoria*, 1916, Entom. Series no. 9, August 1916, pp. 60–62. [Received 3rd January 1917.]

The author urges the advisability of introducing the study of entomology as part of the regular curriculum of schools, more particularly in Canada, where the bulk of the population is agricultural and rural. In his opinion, every teacher should have qualified in this subject before taking up his profession.

Chrystal (R. N.). **The Forest Insect Problem in Stanley Park.**—*Proc. B. C. Entom. Soc., Victoria*, 1916, Entom. Series no. 9, August 1916, pp. 63–66, 1 fig. [Received 3rd January 1917.]

The information contained in this article has already been abstracted [see this *Review*, Ser. A, iv, p. 531].

Treherne (R. C.). **Some Orchard Insects of Economic Importance in British Columbia.**—*Proc. B. C. Entom. Soc., Victoria*, 1916, Entom. Series no. 9, August 1916, pp. 66–83, 7 figs. [Received 3rd January 1917.]

The author reviews the chief insect pests of the northern United States, and the methods most generally employed against them, with a view to their control should they become serious pests in British Columbia. These include:—*Cydia pomonella*, L. (codling-moth), *Eriosoma lanigerum*, Haus. (woolly aphis), *Eucosma* (*Tmetocera*) *ocellana*, Schiff. (bud-moth), *Taeniothrips inconsequens*, Uzel, (*pyri*, Dan.) (pear thrips), and *Eriophyes ribis*, Nal. (black-currant bud-mite).

Gibson (A.). **Superheating as a Control Method for Insects which infest Stored Products.**—*Proc. B. C. Entom. Soc., Victoria*, 1916, Entom. Series no. 9, August 1916, pp. 83–84. [Received 3rd January 1917.]

Insects causing serious losses to flour, stored grain, etc., in various parts of Canada, include *Ephestia kühniella* (Mediterranean flour-moth), *Plodia interpunctella* (Indian-meal moth), *Pyralis farinalis* (meal snout moth), *Sitotroga cerealella* (Angoumois grain-moth) and the weevils, *Calandra granaria* (grain weevil) and *C. oryzae* (rice weevil). Experiments for their control by superheating have shown very satisfactory results. This is preferable to fumigation, as it reaches places inaccessible to gas. Detailed results of experiments are given, and these show that a temperature of 125° F. maintained for about six hours kills all stages of the insects present.

Strickland (E. H.). **Control of Cabbage Aphis by Parasites in Western Canada.**—*Proc. B. C. Entom. Soc., Victoria*, 1916, Entom. Series no. 9, August 1916, pp. 84–88, 3 figs. [Received 3rd January 1917.]

This paper gives an account of the cabbage aphis, *Aphis brassicae*, and the Braconid, *Aphidius* (*Diaeretus*) *rapae*, Curt., which is largely responsible for its control. In dry, cold latitudes, it is possible to encourage this parasite without aiding the Aphid by collecting all old stumps and refuse in the autumn or winter and placing them in a heap

on an absolutely bare piece of ground at a little distance from any green growth, more especially any Cruciferous plants on which *A. brassicae* can feed. In the spring, when the adult parasites emerge and the Aphid eggs hatch, the former, being winged, fly at once to more favourable spots, while the latter die of starvation. This method is only applicable in those localities in which the winter is severe enough to ensure that all refuse of cabbage or turnip crops is completely killed.

GOWDEY (C. C.). **Report of the Entomologist.**—*Ann. Rept. Uganda Dept. Agric. for the Year ending 31st March 1916, Kampala,* 1916, pp. 48–53. [Received 3rd January 1917.]

On coffee, the following pests are recorded :—COCCIDAE. *Coccus viridis*, Green, which is preyed on by two Coccinellids, *Chilocorus discoideus* and *C. punctatus*, and *Coccus africanus*, Newst. ; both of these are controlled by whale-oil soap, kerosene emulsion or resin wash ; *Pseudococcus citri*, Riss., against the aerial form of which carbolic acid emulsion is effective, and in the subterranean form, " Black leaf 40 " (40 per cent. nicotine), or a decoction of tobacco refuse. This scale also attacks the pods of cacao, the leaves of citrus and the tubers of dahlias. *Stictococcus gowdeyi*, Newst., is parasitised by the Chalcidids, *Coccophagus comperei*, Gir., and *Epitetrastichus ugandensis*, Gir. Minor pests on coffee are *Selenaspidus articulatus*, Morg., *Pulvinaria psidii*, Msk., *Ischnaspis longirostris*, Sign., *Ceroplastes ceriferus*, And., *C. galeatus*, Newst., and *C. vinsonioides*, Newst. *C. galeatus* is parasitised by the Chalcidids, *Neomphaloidella ceroplastae*, Gir., *Eurytoma galeati*, Gir., and *Scutellista cyanea*, Motch.

Stem borers of coffee include *Nitocris princeps*, Jord., *Apate indistincta*, Murr., and *Apate monacha*, F., the first-named being parasitised in the pupal stage by a Braconid. The coffee-berry borer, *Stephanoderes coffeae*, Haged., is, in the author's opinion, the most serious coffee pest, and experiments are being made to cope with it. Cutworms are always prevalent in the rainy season. Poison-baits are effective and the collection of larvae by hand proves both advantageous and inexpensive under the local conditions. *Ceratitis capitata*, Wied., was infrequent on coffee, but attacked oranges. *Antestia variegata*, Thunb., (variegated bug) only appeared towards the end of the year, and is being investigated. It threatens to become a serious pest, sucking the juice from the berries and causing them to drop.

Metadrepena glauca, Hmp., often completely defoliates the trees, but the larvae are easily controlled, if taken in time, by a stomach poison of Paris green or lead arsenate. The eggs are parasitised by a Chalcidid.

Cacao was attacked by the following scale-insects :—*Inglisia conchiformis*, Newst., which is a new pest on cacao and is destroyed by the moth, *Eublemma scitula*, Ramb. ; *Stictococcus diversiseta*, Silv., is the worst scale-insect infesting cacao [see this *Review*, Ser. A, iii, p. 288]. Other food-plants growing in the vicinity of cacao may also be attacked, such as croton, hibiscus, custard apple, mulberry and pigeon pea.

Helopeltis bergrothi, Reut. (cacao mosquito), though of recent appearance, threatens to become the most serious cacao pest, both the nymphs and adults sucking the juices from the pods and tender shoots. The eggs are laid singly in young shoots or pods. The nymphs hatch

in about 10 days and moult five times before attaining full growth, which takes about 16 days. The adults may live for two or three months, and are found chiefly in the rainy season. The beetle, *Adoretus hirtellus*, Castn., is found in all cacao plantations. *Toxoptera theobromae*, Schout. (cacao aphis) attacks the tender leaves and flowers. Tobacco decoction, kerosene emulsion and whale-oil soap are the usual treatments against it. The Pentatomid, *Plataspis vermicellaris*, Stål, has only once been found on cacao branches, but it attacks *Erythrina indica*, which is a shade-tree for cacao. The Longicorn, *Sthenias cylindrator*, F. (cacao girdler) completely girdles twigs up to $\frac{3}{4}$ inches in diameter, with the result that the part of the branch beyond the girdle dies.

On cotton the usual pests were found, *Earias insulana* (spiny boll worm) being prevalent.

Miscellaneous pests included *Aspidiotus cyanophylli*, Sign., on banana fruits, and *Pseudococcus bromeliae*, Bch., attacking pineapples.

Three swarms of locusts were reported during the year.

Herrick (G. W.). **The Fruit-tree Leaf-roller in New York State.**—*Canadian Horticulturist, Toronto*, xxxix, no. 12, December 1916, p. 287, 4 figs.

This article contains a short account of the fruit-tree leaf-roller [*Cacoecia argyrospila*] in New York State for the benefit of entomologists and fruit-growers in Ontario, owing to the possibility of its spreading into Canada. It is difficult to control owing to its habit of hiding in the opening buds or rolled up leaves. Spraying with arsenate of lead in strong solutions has not proved effective in cases of severe infestation. The eggs are susceptible to miscible oils applied thoroughly in spring in the proportion of 1 gal. to 5 gals. of water. Only one application should be made and this should be done when the temperature is above freezing. In cases of severe infestation the oils should be supplemented with thorough sprayings of arsenate of lead at the rate of 6 lb. to 100 gals. of water, one application being made before the blossoms open and another after the petals fall. In cases of slight infestation arsenate of lead or a lime-sulphur spray will be sufficient.

Neilson (J. A.). **Fighting the Potato Beetle.**—*Canadian Horticulturist, Toronto*, xxxix, no. 12, December 1916, p. 290.

The potato beetle [*Leptinotarsa decemlineata*] is becoming general throughout Manitoba and the west of Canada. Hitherto, Paris green has been the only poison used to control it in Canada, but owing to the high price of this, a series of experiments was undertaken with home-made arsenate of lime, prepared according to the formulae given by the U.S. Department of Agriculture [see this *Review*, Ser. A, iii, p. 737]. The results were quite satisfactory, arsenate of lime proving as effective as Paris green or arsenate of lead and much cheaper than either. The cost was approximately 3*d*. a pound. The resultant calcium arsenate paste was found on analysis to contain 19·4 per cent. As_2O_5. Paris green should contain 56 per cent. of As_2O_5, so that on the basis of As_2O_5, 2·831 lb. calcium arsenate equals one pound of Paris green. The opinion is expressed that 3 lb. calcium arsenate to 40 gals. of water may be used with safety.

Caesar (L.). **Notes on the Season's Spraying.**—*Forty-seventh Ann. Rept. Fruit Growers' Assoc. Ontario, 1915, Toronto,* 1916, p. 67. [Received 6th January 1917.]

From results obtained the advocacy of spraying has been justified in every respect. In an orchard badly infested with San José scale [*Aspidiotus perniciosus*], in which a large number of the trees were thirty years old and would not have been saved if they had not been sprayed that year, three mixtures were used, viz :—Lime-sulphur, one gal. to seven gals. of water ; soluble sulphur, 12½ lb. to 40 gals. of water ; scalecide at the strength recommended by the manufacturers. Eight gallons were used for each tree, with satisfactory results in each case, the cost being about the same.

Treherne (R. C.). **Insects affecting Agriculturists in B.C. during the past Year.**—*Agric. Jl., Victoria, B.C.,* i, no. 10, December 1916, p. 168.

Otiorrhynchus ovatus (strawberry-root weevil) continues to trouble those interested in the small fruit industry on the coast. To a great extent the problem of control is passing out of the hands of the entomologist into those of the horticulturist. The control of the pear thrips, *Taeniothrips inconsequens* (*pyri*), on the Saanich Peninsula has been investigated [see this *Review*, Ser. A, v, p. 70]. The black currant mite (*Eriophyes ribis*) was dealt with by the Provincial officers during the past year and many infested bushes destroyed. The western ten-lined June beetle (*Polyphylla decemlineata*) and the western strawberry crown-borer (*Aristotelia* sp.) were recorded on many occasions as destructive to the roots and crowns of strawberry plants. The control of these insects rests on the reduction of the number of years the plants are retained for bearing on the same area. The beet or mangold-root aphis was very destructive at certain points on Vancouver Island this year. This insect is believed to be *Pemphigus betae*, and if so, is recorded for the first time in the Province. A report that requires confirmation notes the presence of the cherry fruit fly [*Rhagoletis cingulata*] on the island. In greenhouses, chrysanthemums were attacked by thrips, leaf-miners, the tarnished plant bug [*Lygus pratensis*], and a midge (*Diarthronomyia hypogaea*), this last being recorded for the first time in the Province. Orchids were attacked by the cattleya fly (*Isosoma orchidearum*). *Otiorrhynchus sulcatus* was destructive to potted plants, especially cyclamens and primulas. A spring-tail (*Lipura* sp.) was again reported as appearing in myriads in greenhouse soil. The control of many hothouse pests, especially the last-named, may be effected by sterilisation. The situation respecting the codling moth (*Cydia pomonella*) is the most serious insect problem occurring at present in the Province. Efforts have been made by the Provincial Department of Agriculture at Okanagan Landing and Westbank to reduce the degree of infestation, and equipment has been installed at Vernon for the study of this pest under local conditions. The woolly aphis (*Eriosoma lanigerum*) and the bud-moth (*Eucosma* (*Tmetocera*) *ocellana*) have made serious advances as destructive pests. The lesser apple-worm (*Enarmonia prunivora*) also appears to have increased in the Okanagan Valley. A uniform and systematic practice of spraying will hold these insects in check. The peach twig-borer (*Anarsia lineatella*) is the most important insect pest of the peaches at

the south end of the Okanagan Valley. It is successfully controlled by arsenate of lead sprays. The neglect of the peach trees during the last few years has led to the spread of this moth to apricot, plum and prune trees. Two specimens of the apple maggot fly (*Rhagoletis pomonella*) were taken at Penticton in August, this being the first authentic record of the presence of this insect west of the Rocky Mountains, though it is one of the most destructive pests in Ontario and the Maritime Provinces. The diamond-backed moth (*Plutella maculipennis*) has done considerable damage to root and vegetable crops throughout the Lower Boundary and Columbia Valley sections. The cabbage aphis (*Aphis brassicae*) has caused considerable, and, in certain cases, total loss of crops in these districts. The cabbage-root maggot, *Chortophila* (*Phorbia*) *brassicae*, is also on the increase in the drier sections of the Province. The Colorado potato beetle (*Leptinotarsa decemlineata*) has been reported south of Nelson, but this requires confirmation.

The entomological outlook in the Province is generally good, conditions arising from the war, resulting in absentee owners and neglect of ranches at critical times, causing the most concern.

GIBSON (A.). **The Fumigation and Inspection of imported Nursery Stock under Federal Legislation. The Entomological Branch.**—*Agric. Gaz. Canada, Ottawa,* iii, no. 12, December 1916, pp. 1046–1052, 2 figs.

The legislation enacted for the control of the various insect pests which may be imported into Canada is reviewed in this paper. The San José scale (*Aspidiotus perniciosus*) was at first the only insect dealt with, but the Act now includes *Euproctis chrysorrhoea* (brown-tail moth), *Eriosoma* (*Schizoneura*) *lanigerum* (woolly aphis), *Aulacaspis pentagona* (West Indian peach scale), *Lymantria* (*Porthetria*) *dispar* (gipsy moth), *Ceratitis capitata* (Mediterranean fruit fly), and *Phthorimaea operculella* (potato tuber moth). The requirements governing importations are detailed and the fumigation of imported nursery stock by Federal Inspectors described. The conditions under which nursery stock is allowed to be exported to the United States are also given, and the paper concludes with a table showing the number of plants inspected during the several years from 1909–1916.

GEORGESON (C. C.). **Report of the Alaska Agricultural Experiment Stations 1914.**—*U. S. Dept. Agric., Washington, D.C.*, 22nd July 1915, 96 pp., 12 plates. [Received 3rd January 1917.]

The only insect pest noted at the Sitka Station of any consequence was the root maggot of cruciferous plants (*Chortophila brassicae*), which attacked cabbages and cauliflowers, especially the latter. The varieties of turnips usually grown in the United States were much damaged, but the Petrowski and other turnips from Finland and Sweden suffered little. The Sakurajima radish was almost totally destroyed, while the common varieties practically escaped.

COLEMAN (L. C.). **A Borer in Coffee.**—*Planters' Chronicle, Bangalore,* xi, no. 49, 2nd December 1916, p. 622.

In reply to a request to identify an insect living in burrows on coffee plants, the author states that the specimen in question is the larva of a

tiger beetle and is not a true borer, but makes burrows in the stem of the plant in which to hide and from which it emerges to seize its prey. These beetles are predaceous both in the adult and larval stages and probably the damage they do to coffee is more than counterbalanced by the good done by the destruction of other insects. The larva of another Cicindelid, *Collyris emarginatus,* with a similar habit has been recorded on coffee trees in Java.

Cushman (R. A.). *Syntomaspis druparum,* **the Apple-seed Chalcid.**—*Jl. Agric. Research, Washington, D.C.*, vii, no. 11, 11th December 1916, pp. 487–501, 8 figs., 4 plates, 2 tables.

The apple seed Chalcid (*Syntomaspis druparum*) occurs throughout the northern states from Vermont to Michigan, but has not been recorded from Ohio or Indiana. It has also been found as far south as Clearfield, Pennsylvania, and at Vienna, Virginia. It probably occurs throughout the eastern part of the country wherever small seedling apples (*Malus sylvestris*) are to be found. The only externally visible effect of infestation is caused by the oviposition puncture, which, after a few days, appears as a minute scar situated in a small, shallow dimple. From this scar a discoloured line extends to the seed. Under ordinary circumstances the fruit appears to be able to outgrow both of these manifestations of injury, but when fruit is scarce and the insects very abundant the gross injury due to repeated puncturing at nearly the same spot causes permanent and deep dimpling, with corky, discoloured streaks in the flesh. Injury caused by other insects such as the bugs, *Lygidea mendax,* Reut., and *Heterocordylus malinus,* Reut., is sometimes erroneously attributed to this insect. *S. druparum* has been found infesting the seeds of *Sorbus scandida, S. aria, Pyrus baccata* and *Malus sylvestris,* lady apple and crab apples, both wild and cultivated. It also attacks a few species of cultivated apple. Only the lady apple however is subject to serious attack and the ordinary commercial varieties are never infested except in neglected orchards or when the fruit is stunted from some cause or other. The immunity of cultivated varieties is due to the fact that at the time when the Chalcid is ovipositing, the fruit is so large that the ovipositor cannot reach the seeds. It is not therefore of very great economic importance. Its life-history is described ; it has no specific enemies and the mortality among hibernating larvae is very small. It may, however, be kept under control by purely mechanical means. All wild seedling apples or wild crab apples should be cleared away from the neighbourhood of orchards, preferably in late summer, so as to destroy the largest number of the larvae of the season, and all fallen fruit should be destroyed. Two season's work on these lines should clear the orchard of this pest.

A bibliography of nine references is given.

Nougaret (R. L.), Davidson (W. M.) & Newcomer (E. J.). **The Pear Leaf-Worm.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 438, 11th December 1916, 23 pp. 2 pl., 4 figs.

Gymnonychus californicus, Marl. (pear sawfly) is apparently a native of the Pacific Coast, occurring throughout a range of 1,000 miles. Its original host is probably one or more wild plants related to the pear ;

among cultivated plants, its food is confined to different varieties of pear. There is only one generation in each year. The adults appear in March and April, the females greatly predominating. Eggs are inserted into the leaf, and the larva on hatching apparently emerges through the incision in the leaf made by the adult in depositing the egg. When fully grown, the larva drops to the ground, and buries itself in the soil, seldom burrowing to a depth of more than one inch. Here it weaves a tough brown cocoon, remaining in the ground about 10 months, the last two or three weeks being passed in the pupal stage. The injury is caused entirely by the larva, and occurs on the foliage, but it is only in severe attacks, when the trees are defoliated, that it is of economic importance. The best control is a poison spray of 4 lb. lead arsenate to 100 U.S. gals. of water, and a contact spray of fish-oil soap, 4 lb., water, 100 U.S. gals., nicotine sulphate (40 per cent.) 1 to 1,200, applied when the larvae are about half grown.

HOLLINGER (A. H.). **The Shell-bark Hickory Mealy-bug.**—*Canadian Entomologist, London, Ont.*, xlviii, no. 12, December 1916, pp. 411–413 & xliv, no. 1, January 1917, pp. 19–21.

Pseudococcus jessica, sp. n., from Columbia, Missouri, is described and the life-history and habits are given. The female of this Coccid is attended by small black ants, and probably hibernates in their nests. The larvae of several species of Syrphids appear to be natural enemies of this scale, and apparently are left unmolested by the ants. No parasitic Hymenoptera have been reared from it.

MARSHALL (G. A. K.). **The Fauna of British India. Curculionidae. Pt. 1.**—*London*, Taylor & Francis, 1916 367 pp., 108 figs. [Price 15*s*.].

This volume contains a general introductory account of the family CURCULIONIDAE in its wide sense, the classification adopted being based on Lacordaire's system in preference to that of Leconte and Horn. Only two sub-families are dealt with in detail, the BRACHYDERINAE and OTIORRHYNCHINAE, comprising 342 species, of which 179 are described as new, 15 new genera being also erected.

The damage done to cultivated plants by various species is briefly referred to, and among these may be mentioned :—*Tanymecus indicus*, Fst., the adults of which nibble off the young germinating plants of wheat, peas and gram ; *Astycus lateralis*, F., attacking the leaves of tea and mulberry bushes ; *A. immunis*, Wlk., which sometimes does serious damage to the foliage of tea and coffee ; *Sympiezomias decipiens*, Mshl., injuring young cinchona trees ; *Episomus lacerta*, F., on field beans and attacking the bark of cotton plants ; *Emperorrhinus defoliator*, Mshl., defoliating fruit trees ; *Myllocerus dorsatus*, F., attacking leaves of the sword bean (*Canavalia*) ; *M. sabulosus*, Mshl., destroying young leaves of mango trees ; *M. lefroyi*, Mshl., defoliating cherry trees ; *M. curvicornis*, F., destructive to young leaves of cacao and tea ; *M. discolor*, Boh., the larva of which is a serious pest of sugar-cane, while the adults are general feeders and attack the foliage of many different cultivated plants ; and *M.* 11-*pustulatus*, Fst., the adults of which have similar habits to those of *M. discolor*.

MARSHALL (G. A. K.). **On New Neotropical Curculionidae.**—*Ann. & Mag. Nat. Hist., London,* xviii, no. 108, December 1916, pp. 449–469.

In discussing Mr. Dwight Pierce's paper on *Diaprepes* [see this *Review*, Ser. A, iii, p. 627], the author states that *D. esuriens* should not be treated as a synonym of *D. famelicus,* which was described from Guadeloupe. A distinct race, *D. famelicus elegantulus,* Gyl., occurs in Martinique. The Barbados form is quite distinct from this and was probably introduced from the northern islands. The variety figured by Mr. Pierce as *D. comma,* Boh., is *D. doublieri,* Guér., the true *D. comma* occurring in Venezuela and Trinidad ; that figured as *D. marginatus,* Oliv., is undoubtedly *D. farinosus,* Gyl., and is possibly a synonym of *D. rohrii,* F. The form described as *D. denudatus,* Pierce, is the true *D. marginatus,* Oliv., from Guadeloupe.

The following are among the new weevils described :—*Diaprepes balloui,* sp. n., from Dominica, being the representative in this island of *D. hemigrammus,* Chev., in Martinique ; *D. famelicus barbadensis,* subsp. n., from Barbados on *Agave americana* ; *Pachneus citri,* sp. n., found on citrus in Jamaica ; *P. marmoratus,* sp. n., from a yam plant in Jamaica ; and *Styracopus phaseoli,* gen. et sp. n., from Dominica and bred from larvae boring in the stems of Lima beans, St. Vincent.

FLETCHER (T. Bainbrigge). **Report of the Imperial Entomologist.**—*Rept. Agric. Research Inst. & Coll., Pusa, 1915–16, Calcutta,* 1916, pp. 58–77. [Received 8th January 1917.]

Investigations on cotton bollworms has led to the discovery that there are apparently at least five different species of *Rhogas* which attack *Earias fabia* and *E. insulana.* During June and July, 158 larvae and pupae of *Rhogas* spp. were despatched from Pusa to Hansi, and these parasites are now fully established in the experimental plots there. Rice has suffered from the formation of galls in the stem, caused by a small fly, *Pachydiplosis oryzae,* Wood-Mason, on which further investigations and experiments are being made. The Jassids, *Nephotettix bipunctatus* and *N. apicalis,* were serious pests in the Central Provinces. Attempts to breed these species from eggs in captivity have failed and the life-history from December to June is at present unknown. The Fulgorids, *Sogata pusana, S. pallescens* and *S. distincta* have also occurred in the Central Provinces and the mealy-bug, *Ripersia sacchari niger,* at Balasore. Sugar-cane borers apparently belong to two or more species of *Diatraea,* which also occasionally attack juar and maize ; the normal borer of the latter, *Chilo simplex,* is rarely found in sugar-cane. In the Central Provinces an effort is being made to check boring pests, in this case principally *Schoenobius,* by varying the time of planting sugar-cane. A memoir on *Pyrilla aberrans* is being prepared. The sugar-cane Aleurodid, *Aleurolobus barodensis,* caused considerable damage in Tharsa ; attempts to discover any important parasite of this pest were unsuccessful. *Papua depressella,* which usually bores the roots of cane, has now been found attacking young shoots of newly-planted cane, causing greater damage than either *Diatraea* or *Scirpophaga.* Lead arsenate proved the best preparation for protecting cane setts against termites, but further experiments for the protection of the new shoots in setts are being undertaken. On indigo, the indigo Aphid

and *Dichomeris ianthes* were reported from North Bihar; soap sprays gave good results against them. Coffee suffered from a serious outbreak of coffee borer, *Xylotrechus quadripes*, in Coorg. Beetles began to emerge in the last week of October. Eggs were obtained and hatched out and it was proved that sunshine is not essential to the hatching of the eggs, as former observers have stated. Experiments to ascertain the life-cycle are being carried on.

Orchard and garden pests have been made the subject of special study; *Myiopardalis pardalina* (Baluchistan melon fly) was reared at Pusa from fruits of *Cucumis trigonus*; hitherto it has only been found in north-west India. *Dacus oleae* (European olive fly) was also found on wild olives in the North-West Frontier Province; this discovery is important in view of the attempts now being made to introduce the European olive into north-west India and Kashmir.

In the course of the life-history investigations at Pusa, insects reared successfully for the first time numbered about 200 species, including some 50 Coleoptera whose breeding places and habits were previously unknown. One Elaterid beetle grub, *Agrypnus* sp., has been living in the insectary for 21 months on Scarabaeid and other beetle larvae which damage plant roots in the soil. *Bruchus affinis* has been the subject of detailed investigation. The grubs of this beetle are brought into stores inside peas, which are externally quite sound at harvest-time, about the end of January. The beetles begin to emerge in August, but do not become active until December or January, the majority remaining inside the peas and thus being taken back to the field at sowing-time. Treatment with carbon bisulphide or naphthaline has successfully prevented damage to stored peas, and when immersed in water, the damaged seeds float, while those unattacked sink; it is therefore easy to separate the affected seeds and avoid liberation of the beetles in the field at sowing time. *Bruchus chinensis* breeds throughout the year in stored pulse seeds as well as in *Phaseolus mungo, P. radiatus, P. aconitifolius, Dolichos biflorus, Lathyrus sativus, Cajanus indicus, Vigna catjang* and various kinds of peas.

Investigations were continued into the manner in which *Agrotis ypsilon* passes through the hot weather [see this *Review*, Ser. A, iv, p 96]. In the insectary this moth continued to breed throughout this period, but no fertile eggs were obtained from adults which emerged in July and August. During 1916 an Andres-Maire trap was worked throughout the hot weather at Pusa, but failed to attract a single example of *A. ypsilon*, and it is not yet known what happens at this time under normal conditions. The insect can continue to breed under favourable conditions, but there is no proof that it does so, and no trace of the insect has been found in the field from April to August. The migration theory fits the known facts but as yet remains an unproved hypothesis. The habits of *Metriona circumdata, Aspidomorpha indica*, and *Philemostoma trilineata* were observed throughout the year. These beetles hibernate and live for about six months. The moth, *Ancylolomia chrysographella* was observed to hibernate in the larval stage and breeds continuously in the hot weather. The Tineid larvae, *Melasina* sp. and *Myrmecozela leontina*, were observed to have only one brood in the year; hibernation, as well as aestivation, was noted in the case of the Sphingid, *Leucophlebia lineata*, in the larval

stage, in the Chrysomelid, *Oides bipunctata*, in the egg, and in the Noctuid, *Polytela gloriosae*, in the pupal stage. The Trypetid, *Dacus* (*Bactrocera*) *cucurbitae* (fruit-fly) is capable of living in confinement in the adult state for more than three months, and it seems probable that many fruit-flies live from season to season in this state. The stems and galls on the stems of Cucurbitaceous plants were found to be just as suitable as the fruit as breeding-places for the flies.

Complete life-cycles were observed of *Danais plexippus*, on *Oscystelona esculentum*, a new food-plant; the Jassid, *Kolla mimica*, on rice, other Jassids on sugar-cane and *Cyperus rotunda*; *Polia consanguis*; a Halticid beetle on *Anisomeles ovata*; and *Cyrtacanthacris ranacea*. Observations were made on the habits of many other species, and special attention was paid to leaf-mining Lepidoptera, of which many hitherto undescribed species were bred from crops and plants. Attempts to breed *Nephotettix bipunctatus*, *Zonabris pustulata*, *Lytta actaeon* and *Heliocopris bucephalus* were unsuccessful.

Fruit-flies were reared in large numbers to ascertain the proportion parasitised, but the only species that was attacked to any extent was *Carpomyia vesuviana*, the larvae of which live in fruits of *Zizyphus jujuba*. An endeavour was made to introduce the parasite into Italy, but owing to postal delays, this was found to be impossible. Experiments with insecticides proved that a spray of gur and lead arsenate killed fruit-flies in about 36 hours.

Pests of stored products were investigated, and the lime treatment of rice proved most satisfactory on a small scale; further tests on a larger scale will now be made with this and other stored grain.

Galleria mellonella (wax-moth) gained entrance to the bee-hives at an unexpected period (December) and destroyed some colonies of *Apis indica*, which were being studied with a view to checking swarming and increasing the yield of honey. No further experiments have been made with European bees owing to the danger of introducing Isle-of-Wight disease into India.

Experiments were carried out with *Tricolyga sorbillans*, Wied., the Tachinid parasite of silkworms, the following caterpillars being exposed to the attacks of this fly:—*Bombyx mori* (mulberry silkworm), *Attacus ricini* (Eri silkworm), *Achaea janata*, *Spodoptera mauritia*, *Polytela gloriosae*, *Anomis* (*Cosmophila*) *sabulifera*, *Papilio demoleus*, *Utetheisa pulchella* and *Diacrisia obliqua*. The flies were found to oviposit on all varieties of caterpillars, both hairy and smooth, but could not breed in them so successfully as in silkworms.

Barnes (J. H.) & Grove (A. J.). **The Insects attacking Stored Wheat in the Punjab, and the Methods of combating them, including a Chapter on the Chemistry of Respiration.**—*Memoirs of the Dept. Agric. in India, Calcutta*, iv, no. 6, November 1916, pp. 165–280, 5 plates, 12 figs.

The following are recorded as damaging wheat in the Punjab:—Coleoptera: the Cucujid, *Laemophloeus* sp.; the Dermestid, *Attagenus undulatus*, Motch.*; the Bostrychid, *Rhizopertha dominica*, F.;

* Mr. G. J. Arrow informs us that this species has been incorrectly identified. The insect is a *Trogoderma* and has generally been referred to *T. versicolor*, Kreutzer, but Mr. Arrow considers that it will probably prove to be an undescribed species.—Ed.

the Tenebrionids, *Tribolium castaneum*, Hbst., *Latheticus oryzae*, Waterh., and *Alphitobius piceus*, Ol.; the Curculionids, *Calandra oryzae*, L., and *C. granaria*, L.; Lepidoptera: *Sitotroga cerealella*, Oliv.

By far the most important of these are *A. undulatus*, *R. dominica*, and *C. oryzae*, as these species alone damage uninfested wheat; the others attack grain which has already been damaged by other insects, or their attacks on sound grain are of no importance. The life-history and distribution of these three species in the Punjab and their effect on grain are given in detail.

A. undulatus has four generations in a year. The adult does not damage the grain, but the larva is a voracious feeder, passing through as many as ten successive moults and feeding directly after each. They are generally found near the surface of the wheat, and render the parts of the grain that are badly infested hot to the touch. These larvae, unlike the adults of *R. dominica* and *C. oryzae*, consume all the material they gnaw from the grains and consequently wheat attacked by this beetle does not become mixed with the floury matter that characterises the attacks of the other two insects. The frass produced consists almost entirely of excrement composed of small whitish pellets. The larvae were found to be unable to penetrate into entire grains until after the third moult.

R. dominica is the only grain-attacking insect which is ever observed on the wing. There are probably five generations in a year. Both larvae and adults attack the wheat, reducing the grains to a mass of flour, which probably forms suitable food for the young larvae. These larvae were found to be unable to penetrate entire grains, though the smallest crack or abrasion in the pericarp, due to the work of the adults, enabled them to do so.

C. oryzae is the best-known grain pest in India and has already received much attention from entomologists. As in the case of *R. dominica*, the most noticeable effect is produced by the adults. The eggs are laid, not on the surface of the grains, but inside the pericarp, which renders the damage by the young larvae, feeding inside the grain, very difficult to detect. The generations average three or four in a year. The adult damages the grain by piercing the pericarp with its proboscis.

Attacks from one or other of these species seems to be continuous throughout the year. *A. undulatus* is the most capable of withstanding adverse conditions, while *R. dominica* and *C. oryzae* are more prolific. Notes on the life-histories of the less important species are also given.

Infestation most probably arises from the insects already present in the cracks and crevices of the storehouses into which the wheat is put, but, as all these insects are winged, it is possible that they may enter the storehouse by flying.

The authors have carried out a series of careful and comprehensive experiments in order to determine the best method of control. For the purpose of these experiments wheat was placed in thin galvanized iron bins, which are always greatly preferable to the earthen floor of the mud hut that constitutes the usual storehouse in the Punjab. The former methods of control are reviewed, experiments having been made to test the efficacy of all of them. The results of these are given

in a series of tables. The use of highly inflammable and poisonous gases is deprecated, owing to the necessity for employing ignorant native labour. Carbon dioxide and sulphur dioxide have both been proved to cause a loss of vitality in the wheat, while both of these gases are useless as asphyxiating agents, owing to the ability of the insects to enter a state of hibernation in the absence of oxygen. Moisture and dryness have been considered important factors in control, but while desiccation is an effective remedy against *C. oryzae*, *A. undulatus* seems to prefer dry conditions to moist ones, while *R. dominica* is apparently indifferent to either.

Chemical deterrents, such as naphthaline, have been found successful in the case of stored maize [see this *Review*, Ser. A, ii, p. 204], but while wheat may be preserved for seed purposes by this means, it cannot afterwards be sold for food, owing to the objectionable taste and odour it acquires.

Mechanical separation of weevils from the wheat has been proved by scientific enquiry to be the best and most efficient method. This is often done by means of a sieve in the Punjab villages. The adults of *R. dominica* and *C. oryzae* can easily be sifted out, but the larvae of *A. undulatus* must be removed when young, or better still in the egg stage. A mechanical treatment is therefore necessary which will combine the advantage of sifting with those of a density separation, any substances which are of less density than undamaged wheat being "floated out." The damaged grain will be proportionately lighter according to the amount of endosperm eaten away, and will be carried away by a current of air more easily than sound grains. The separator designed by the authors consists of a tube, in this case constructed of thin sheet iron, with a number of bends, each at an angle of 40° with the perpendicular, the object being to neutralise the increasing momentum of the falling grain due to gravitational acceleration. With a sufficiently long tube, divided into a sufficient number of steps, a uniform velocity can be obtained for the falling grain. An air-blast sent up the tube at an increasing velocity will reach a point when its momentum is equal to that of the falling grain. At this point the grain will "float." Immediately below each bend of the tube there is an egress port; at each of these a portion of the uprushing current of air escapes carrying with it all matter that is light enough to "float" in it. The amount of air escaping at each port will be less as it travels higher in the tube, so that at the top of the tube only the lightest materials, insects, dust, detritus, etc., are removed. The grain still travelling down the tube meets an increasingly stronger current of air and the heavier damaged materials are blown out; first dust, then shells and then the more or less damaged grain. When this method is used, by-products of varying value can be collected from the various egress ports.

After a preliminary cleaning by this process, a number of eggs are likely to be left attached to the epidermis of the wheat. A second cleaning should therefore be undertaken as soon as sufficient time has elapsed for the adult insects to emerge without having oviposited. Such wheat should be stored in bins or chambers so constructed that there are no cracks or corners in which insects can lodge.

This paper contains a large amount of detail unsuitable for an abstract and should be read in the original by those interested.

van der Goot (P.). **On some undescribed Aphides from the Collection of the Indian Museum.**—*Records Indian Museum, Calcutta*, xii, no. 1, February 1916, pp. 1–4, 2 figs. [Received 9th January 1917.]

The following new Aphids are described :—*Rhopalosiphum indicum* and *Trichosiphum minutum* from Darjiling, and *Pterochlorus tropicalis* from Assam.

Maulik (S.). **A new *Chlamys* from Calcutta.**—*Records Indian Museum, Calcutta*, xii, no. 3, May 1916, pp. 101–103, 1 fig. [Received 9th January 1917.]

A description is given of the Chrysomelid, *Chlamys gravelyi*, sp. n., found on *Ziziphus jujuba* at Calcutta.

de Peyerimhoff (P.). **Description de la larve de *Lasiodactylus chevrolati*, Reitt. (Coleoptera, Nitidulidae).** [Description of the Larva of *Lasiodactylus chevrolati*, Reitt.]—*Records Indian Museum, Calcutta*, xii, no. 3, May 1916, pp. 109–113, 3 figs. [Received 9th January 1917.]

The larva of this beetle is described from specimens of all ages taken on fallen and decayed fruit of *Melia azadirachta* in Madras Province.

Gravely (F. H.). **Some lignicolous Beetle Larvae from India and Borneo.**—*Records Indian Museum, Calcutta*, xii, no. 4, August 1916, pp. 137–175, 3 plates. [Received 12th January 1917.]

This paper gives some descriptions and a number of references to the bibliography of the larvae of the following families :—Passalidae, Lucanidae, Cucujidae, Buprestidae, and Tenebrionidae.

Pierce (W. D.). **Studies of Weevils (Rhynchophora) with Descriptions of new Genera and Species.**—*Proc. U.S. National Museum, Washington, D.C.*, li, 16th December 1916, pp. 461–473.

The new species described in this paper include :—*Leiomerus granicollis*, sp. n., in cassava stems from Brazil, and *Eisonyx* (*Eumononycha*) *picipes*, sp. n., found in a strawberry field and among the roots of asters in Tennesee.

Girault (A. A.). **Australian Hymenoptera Chalcidoidea. General Supplement.**—*Mem. Queensland Museum, Brisbane*, v, 10th July 1916, pp. 205–230. [Received 11th January 1917.]

This paper is a supplement of a previous one [see this *Review*, Ser. A. iv, p. 153]. The new species described include :—*Pterygogramma acuminata*, gen. et sp. n., bred from eggs of a Jassid embedded in twigs of *Eucalyptus* ; *Alaptus immaturus*, sp. n., bred from sugar-cane leaves containing leaf-hopper eggs, but not proved to be parasitic on them ; *Paranagrus optabilis*, gen. et sp. n., bred from the eggs of *Perkinsiella saccharicida* ; *P. perforator*, sp. n., bred from the eggs of Delphacid leaf-hoppers ; *Polynema reduvioli*, sp. n., parasitic in eggs of *Reduviolus blackburni* in the Hawaiian Islands ; *Anagrus frequens*, sp. n., bred from eggs of Delphacids ; *Paruriella viridis*, sp. n., reared from the seeds of grass (*Panicum* sp.).

GIRAULT (A. A.). **New Javanese Chalcidoid Hymenoptera.**—*Proc. U.S. National Museum, Washington, D.C.*, li, no. 2161, 16th December 1916, pp. 479–485.

The new species described include:—*Leptomastix trilongifasciatus*, sp. n., reared from *Pseudococcus* on *Leucaena glauca* and *Coffea*; *Parechthrodryinus convexus*, gen. et sp. n., from a Coccid on twigs of *Deguelia microphylla*; *Coccophagus javensis*, sp. n., from *Pseudococcus* on wild *Mangifera*; *Omphalomyia thymus*, sp. n., a secondary parasite of *Zaratha*; *Cheiloneuromyia javensis*, sp. n., *Cristatithorax latiscapus*, sp. n., *Coccophagus javae*, sp. n., *Asemantoideus dubius*, gen. et sp. n., *Epitetrastichus lecanii*, sp. n., *E. ibseni*, sp. n., and *Anysis australiensis javensis*, var. n., all bred from *Coccus* (*Lecanium*) *viridis*.

A New Insect Enemy of the Peach.—*Science, Lancaster, Pa.*, xliv, no. 1148, 29th December 1916, pp. 924–925.

The subject-matter of this paper dealing with the life-history of *Cydia* (*Laspeyresia*) *molesta* has already been abstracted [see this *Review*, Ser. A, v, p. 757].

It is requested that the presence of this pest on peach or other fruit trees should be reported to the Department of Agriculture, Bureau of Entomology. It is not at present thought to have spread beyond the District of Columbia and the adjoining territory in Maryland and Virginia.

SMITH (H. S.). **The Habit of Leaf-oviposition among the Parasitic Hymenoptera.**—*Science, Lancaster, Pa.*, xliv, no. 1148, 29th December 1916, pp. 925–926.

An investigation of the life-history and habits of the Chalcid, *Perilampus hyalinus*, a hyperparasite of the fall webworm (*Hyphantria cunea*) is here described. The first stage larva or planidium crawls about on the outside of the caterpillar and later bores its way into the body cavity, there swimming about freely until the larva of the primary parasite, either Hymenopterous or Dipterous, is found. When it has gained entrance into this host, it remains quiescent until the primary parasite is full-fed and has made its exit from the caterpillar to pupate. The planidium then finds its way to the exterior of its host, after which it feeds as an ectophagous parasite in the normal way. The oviposition habits of this parasite have only recently been discovered. Several adult female *Perilampus* were captured hovering about oleanders infested with *Aphis nerii* and fed upon *Chrysopa*. These were placed in vials, each with an oleander leaf bearing egg-clusters of *Chrysopa*, and were observed to oviposit directly on to the leaves. The eggs are numerous, one female depositing fifty-two in one day. They hatch in seven to ten days and the first stage larva is of the planidium type. It is active at first, crawling rapidly about, but later attaches itself to a leaf by the caudal end, standing out at right angles to the surface, where it awaits the approach of a *Chrysopa* larva to which it attaches itself by means of its numerous hooks. The advantage gained by this habit from the standpoint of the species infesting *Chrysopa* is difficult to understand, but in the case of *P. hyalinus* and other species of similar habits, as well as in the case of those infesting

wood boring Coleoptera and gall-making and stem-infesting Lepidoptera, the advantage is obvious, as access is thus easily gained to the endophagous host.

Phillips (W. J.). *Macrosiphum granarium*, **the English Grain Aphis.**—*Jl. Agric. Research, Washington, D.C.*, vii, no. 11, 11th December 1916, pp. 463–480, 1 fig., 3 plates, 3 tables.

Macrosiphum granarium, Kirby, is widely disseminated throughout the United States. This paper deals with some hitherto unrecorded facts connected with its life-history and discusses the colour variation in relation to the sexes, as well as the synonomy. This Aphid does not confine itself exclusively to the small grains, but will live and thrive on a number of wild and cultivated grasses. Among other plants it has been recorded on:—*Agrostis vulgaris, Bromus secalinus, Dactylis glomerata, Poa pratensis*, timothy (*Phleum pratense*), maize (*Zea mays*), *Elymus* sp., *Capsella bursa-pastoris, Lyntherisma sanguinale, Echinochlca crusgalli* and *Hordeum pusillum*, and it has been bred in confinement on many other grasses.

The most efficient enemy of *M. granarium* is undoubtedly the Braconid, *Aphidius nigripes*, Ashm. Just before the harvest, if this parasite is numerous, the heads of grain will be almost covered with the brown dead bodies of the Aphid. *M. granarium* has been recorded as being attacked by the following enemies:—Coleoptera: *Podabrus tomentosus*, Say, *Coccinella 9-notata*, Hbst., *C. sanguinea*, L., *Hippodamia parenthesis*, Say, *H. convergens*, Guér., *H. 13-punctata*, L., *H. glacialis*, F., *Anatis 15–punctata*, Ol., *Megilla maculata*, DeG.; Diptera: *Allograpta obliqua*, Say, *Sphaerophoria cylindrica*, Say, *Xanthogramma emarginata*, Say, *Syrphus americanus*, Wied.; Hymenoptera: *Aphidius avenaphis*, Fitch, *A. granariaphis*, Cook, *Praon americanus*, Ashm., *P. brunneiventris*, Ashm., *P. ferruginipes*, Ashm., *Isocratus vulgaris*, Wlk., *Encyrtus websteri*, How., *Pachyneuron micans*, How., *Allotria tritici*, Fitch, *Tetrastichus ingratus*, How. [n. n.], and *Megaspilus niger*, Curt. These are not however all primary parasites; *Pachyneuron* sp., and *Allotria* sp., have been definitely proved to be secondary ones and it is probable that many others will also prove to be so on further investigation. This Aphid seems to be very susceptible to fungus attack.

A bibliography of 15 references is given.

Leefmans (S.). **Over** *Helopeltis* **in Theetuinen.** [*Helopeltis* **in Teagardens.**]—*Dept. van Landbouw, Nijverheid en Handel, Buitenzorg, Med. Proefstation voor Thee*, no. xlvi. 1916, 21 pp.

In this interim report the author describes two years investigations into the species of *Helopeltis* infesting tea in Java.

Many planters still regard injury by these bugs as a disease, so that cultural control methods are pursued and direct control is neglected. Of the four species of *Helopeltis* which are known to occur in Java, *H. antonii*, Sign., *H. theivora*, Waterh., and a third—probably *H. cinchona*, Mann, are injurious to tea. The fourth species, *H. cuneatus*, Dist., is believed to be harmless to tea. It was found that the inferior varieties of tea suffered most. Java tea cannot be used as a trap-plant and should preferably be removed as being dangerous. At

altitudes under 4,300 feet, *H. antonii* injures both tea and cinchona, while higher up it is represented by a larger, darker-coloured variety which usually prefers cinchona and which is probably the species formerly described as *H. bradyi.* On some estates this variety occurs on tea at a lower level, about 4,000 feet. Above 4,300 feet, *Helopeltis* has not done serious injury up to now, but below that elevation cinchona is a dangerous neighbour for tea. Preliminary experiments were made with many green-manure plants and weeds. Various species of *Tephrosia*, especially *T. vogelii*, which have already established themselves in some estates, are dangerous. *Bixa* and *Gardenia* are also dangerous as being possible food-plants. Clean weeding, immediately after pruning, and the simultaneous pruning of green-manure plants are the measures advised. In Java infestation is most serious during the west monsoon; it decreases and disappears during a prolonged drought. The natural enemies of *Helopeltis* include Mantids, Reduviid bugs and spiders. Spiders were successfully imported from Europe and hundreds of thousands were released, but up to now none have been recovered. A specimen of *Helopeltis* has been found infested by *Metarrhizium anisopliae*, but this fungus cannot be expected to be an important enemy. The results of research regarding the relation between *Helopeltis* and cultural operations in tea-growing were not conclusive. An instance of success with forced plucking was reported from Soekamadjoe, but this may not apply everywhere. In investigating the occasional spontaneous disappearance of *Helopeltis* no proof was obtained of the tea plants becoming immune, though the strongest tend to survive. There is no ground for believing that individual plants are not susceptible to the punctures of *Helopeltis* or that the bugs avoid certain tea plants. Lack of food due to intense and uniform attack, the removal of the insects by wind, prolonged drought and sunny weather, may combine to bring about the spontaneous disappearance of the insects. High table-pruning during and after an outbreak seemed to give better results than close pruning. Prunings should be destroyed, at any rate during the west monsoon, and the stems bearing eggs should be removed. On one estate where capture was practised for four months at a cost of about 3*s.* 9*d.* per acre per month, this expense was held to be fully justified by a comparison with another property where this method was not adopted. Experiments in spraying with a 2 per cent. soap solution, a control new to Java, gave good results if the applications were made immediately after pruning and areas of 70 acres or more were pruned within one month. On plants with dense foliage the result was not so favourable. On 280 acres searched and sprayed the area of severe infestation only amounted to 3–5 per cent. after seven months. The cost of searching and spraying was about 2*s.* per acre per month.

d'Herculais (J. K.). **La Guerre contre les Sauterelles. Les dernières Invasions dans l'Afrique du Nord. Moyens de Défense et de Destruction.** [The War against Locusts. The last Invasions into Northern Africa. Control Measures.]—*Bull. Soc. Nat. d'Acclimatation, Paris*, xliii, nos. 11 & 12. November & December 1916, pp. 460–467 & pp. 508–578.

In this article the author reviews the work done in controlling *Dociostaurus* (*Stauronotus*) *maroccanus* and *Schistocerca peregrina* in

Northern Africa, dating back to 1888. Up to 1914 the methods employed for locust control were based on the English method used in Cyprus and the American methods. These comprised the raising of barriers and the digging of ditches, lined with sheets of zinc bent over at the top so as to prevent the locusts from getting out of them when once they have fallen in, and the use of sprays and baits. In 1914 and 1915 a series of experiments were made with *Coccobacillus acridiorum*, reports of which have already been abstracted [see this *Review*, Ser. A, iv, pp. 44, 45, 351, etc.].

KRAUS (R.). **Experiments in Locust Control by Means of** *Coccobacillus acridiorum* **in Argentine.**—*Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, vii. no. 9, September 1916, pp. 1383–1384. (Abstract from *Centralbl. für Bakt., Parasit. u. Infektionskr., Jena*, xlv, no. 18–25, 19th June 1916, pp. 594–599.) [Received 3rd January 1917.]

Experiments with *Coccobacillus acridiorum*, conducted in Argentina by a commission appointed by the Ministry of Agriculture, have led to the following conclusions :—(1) It is not possible to produce in the open field the epidemic infection and death of young locusts by spraying with a culture of this organism, the virulence of which has been increased by successive passages ; (2) the organism is a normal inhabitant of the intestine of healthy locusts and only kills them when injected into the abdominal cavity ; (3) infection does not occur when it is administered to young locusts with food.

DA COSTA LIMA (A.). *Anastrepha serpentina*, **a Dipteron injurious to several Fruit Plants in Brazil.**—*Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, vii, no. 9, September 1916, p. 1390. (Abstract from *Bol. Minist. Agric., Indust. e Comm., Rio de Janeiro*, iv, no. 3, pp. 99–104, 1 plate.) [Received 3rd January 1917.]

The fruit-fly, *Anastrepha serpentina*, Wied., has been found in Brazil [see this *Review*, Ser. A, iii, p. 387] and is known to damage the fruit of *Mammea americana*, *Chrysophyllum cainito*, *Mimusops cariacea* and *Achras sapota*. The female bores a hole in the pericarp and deposits eggs in it ; the larvae, which hatch within three or four days, feed on the pulp, in which they tunnel, often causing the fall of the fruit. Methods of control include gathering and destroying the damaged fruit, spraying with sweetened arsenical solutions every 15 days, and the use of vessels containing poisoned baits suspended from the branches of the plants attacked.

DAWE (M. T.). **Pulgon (Flea-Beetle) que ataca las Plantaciones de Patatas en los Páramos.** [A Flea-beetle which attacks Potato Plantations on the Plateaux.]—*Revista Agrícola, Bogotá*, ii, no. 8, August 1916, pp. 458–461. [Received 10th January 1917.]

Epitrix nigroaenea, Har., attacks the young, tender leaves of potatoes as soon as they begin to appear, and sometimes ruins an entire plantation. This species closely resembles *E. cucumeris*, Harr., which is a very common potato pest in North America, its attacks being frequently accompanied by a fungus disease. Further experiments are necessary

to determine the best method of control of *E. nigroaenea*, but meantime the following recommendations are given. In North America a dry spray, made of a mixture of 1 lb. Paris green, and 20 lb. calcium sulphate, is applied in the morning while dew is still on the plants. A wet spray of ¼ lb. Paris green, 40 gals. water, and ¼ lb. slaked lime, or 2 to 3 lb. lead arsenate dissolved in the same quantity of water, is recommended. As Bordeaux mixture is a remedy for the fungus disease which often appears simultaneously with the insect, a good control is a combination of Bordeaux mixture and arsenic, consisting of sulphate of copper, 6 lb. ; slaked lime, 6 lb. ; water, 40 gals. ; to which is added a mixture of 40 gals. water with 8 oz. Paris green or 3 lb. lead arsenate. The spraying should begin when the shoots are a few inches high and, when the pest is abundant, should be repeated twice a week.

PAILLOT (A.). **Les Coccobacilles du Hanneton. Action pathogène sur quelques Chenilles de Macrolépidoptères.** [The Coccobacillus of the Cockchafer. Its Pathogenic Action on some Caterpillars of the Macrolepidoptera.]—*C. R. Soc. Biol., Paris,* lxxix, no. 20, 16th December 1916, pp. 1102–1103.

Four different species of *Coccobacillus* have been isolated during the year from cockroaches in the district round Lyons and in the Jura. These have been classed provisionally as varieties of *Bacillus melolonthae*. A fifth type, closely allied to *B. melolonthae liquifaciens*, is however distinguished from it by some culture peculiarities and especially by its action on the rabbit. A series of experiments have been performed with these organisms on cockchafers and on the larvae of *Vanessa urticae*, *Lymantria dispar* and silkworms. Cockchafers inoculated with *B. melolonthae liquifasciens* died in 24–36 hours after direct inoculation. After nine passages they died in 10–12 hours. These results are similar to those obtained by Chatton with *B. acridiorum* [see this *Review*, Ser. A, i, p. 306]. The other varieties of *Coccobacillus* gave similar results. The virus obtained after the ninth passage did not cause infection when given by the mouth. Larvae of *Vanessa urticae* are very sensitive to the action of these bacilli. Death supervened in less than 24 hours after direct inoculation and in 10–12 hours after the fourth passage, though virus of this strength does not kill when given through the mouth. Twenty-three successive passages were made with type II. of *B. melolonthae liquifasciens* ; at the sixth, death supervened in 9–10 hours, at the 20th in 7–9 hours. No higher rate of virulence could be obtained, and this may be taken as the maximum. This virus was also incapable of infecting healthy larvae when given by the mouth. The same strain was used for inoculating larvae of *Lymantria dispar*. The first injection was made direct from the blood of the last *Vanessa urticae* inoculated ; death supervened at the end of 20–24 hours. At the second passage, the rate of virulence had increased considerably and death occurred at the end of 10–12 hours. The increase was then slight up to the 23rd passage, when it caused death at the end of 9–10 hours. Silkworms respond to a certain extent to the action of this *Coccobacillus*.

Repeated passages through organisms which differ from the original host do not appear to alter the characteristics of these bacilli.

GUENAUX (G.). **Comment lutter contre la Cochylis et l'Eudémis.** [The Control of *Clysia ambiguella* and *Polychrosis botrana*.]—*Vie Agric. et Rurale, Paris*, vi, no. 50, 9th December 1916, pp. 430–434, 7 figs.

As *Clysia ambiguella* has two generations annually and *Polychrosis botrana* three, the campaign against these insects has to be carried on through all seasons. At the beginning of autumn, the larvae of the second generation of *C. ambiguella* and the third generation of *P. botrana* leave the ripe grapes and seek winter quarters, chiefly in the old bark of the stock, a little distance above the ground, and here the larva remains quiescent in its cocoon throughout the winter. During this period, decortication is the method of control, and it seems scarcely necessary to burn the old bark scraped off, as the pupae when dislodged from their shelter fall exposed to the ground and die in enormous numbers. Decortication is not necessary every year; if a large area be thus treated, one decortication should be sufficient for three years, and whitewashing may take its place as an alternative measure. In cold climates the branches should be washed over after decortication with a 25 per cent. milk of lime, which completes the work of destruction and at the same time forms an isolator. Although the value of decortication is undoubted, scalding is a method that is often preferred owing to its greater simplicity. The object of this treatment is to kill all larvae or pupae by injecting water, as near as possible to boiling point, under all the crevices in the bark. This should be done immediately after the vintage, and should be carried out from the base of the stock, advancing slowly upwards as far as the first buds, which must not be touched. The best apparatus for the purpose is a boiler provided with a length of rubber tubing ending in a bent jet. Owing to the large quantity of water required, vaporisation has been tried as a substitute; this however requires a large and elaborate installation and is only suitable for large areas. Whitewashing the trunk with insecticide solutions is a very favourable measure, but is less efficacious. The following formulae have given the best results:—(1) Heavy coal-tar oil, 20 lb.; carbon bisulphide, 10 lb.; caustic soda, 2 lb.; quick lime, 40 lb.; water, 20 gals. The lime is first slaked and mixed with 10 gallons of water. The oil and carbon bisulphide are mixed separately and added very gradually to 10 gallons of water containing the caustic soda in solution. This heavy emulsion is dropped into the lime solution, stirring all the time. The mixture should not be prepared more than 24 hours before use. (2) Heavy coal-tar oil, 20 lb.; carbon bisulphide, 10 lb.; oleic acid from stearine factories, 4 lb.; caustic soda, 1 lb.; water, 20 gals. The coal-tar oil, the oleic acid and the carbon bisulphide are mixed together and poured into the water to which the soda has been added, stirring all the time until a perfectly homogeneous emulsion is obtained. Insecticide washings should not be begun before the middle of March, as it is only when the sap begins to rise that sufficient resistance is offered to the wash, which at other times may be absorbed to the injury of the plant.

Shelter-traps, made by wrapping bands of cloth round the trunks and at the forks of the branches in early autumn, have been the means of collecting many pupae in December; these have the additional advantage of preserving the parasites of the moths.

COUANON (G.) & SALOMON (E. & R.). **L'Emploi de l'Eau chaude contre les Parasites de la Vigne.** [The Use of Hot Water against Vine Pests.]—*Rev. Viticulture, Paris*, xlv, no. 1171, 7th December 1916, pp. 372–373.

A series of experiments in the use of hot water as a control for the larvae of *Clysia ambiguella* and *Polychrosis botrana* were made by the authors on a vine trellis in July 1916, when the second period of oviposition of the moths should have been completed. The apparatus used was an ordinary garden syringe with a flat rose, the water being drawn from a Vermorel boiler. The temperature in the shade was about 73° F.

When water at 168° F. in the syringe or 158° F. by the time it reached the grapes was used, the fruit was destroyed. At 150° F. in the syringe and 146° F. on the grapes, no harm was done to either vines or leaves.

A similar experiment on a pear espalier very severely attacked by honey-dew and sooty fungus (*Capnodium*), using water at 158° F. in the syringe and 151° F. on the leaves, was most successful.

FEYTAUD (J.). **Recherches sur les pièges-appâts. III. Le Pourcentage des Sexes.** [Experiments with Bait-traps. III. The Percentage of the Sexes.—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xv, nos. 11–12, November-December 1916, pp. 113–118.

This paper supplements others already abstracted [see this *Review*, Ser. A, iv, p. 309, 492].

Various authors are agreed that the usual percentage of the sexes of *Clysia ambiguella* and *Polychrosis botrana* is 40 females to 60 males. The proportions among the moths taken from various traps is found to be about the same, a greater proportion of females being captured during fine and calm weather [see this *Review*, Ser. A, i, p. 416]; the month of July is therefore usually the best time for bait-traps. The atmospheric conditions being the same in various vineyards in one locality, the relative percentage of the sexes captured might be expected to be the same throughout. This however is not the case, and further investigation has shown that in vineyards where the traps are uniformly distributed the percentage of females captured is higher than in those where the traps are set in groups widely interspaced. The reason seems to be that the females have neither the fine perception exhibited by the males for the odour emanating from the traps nor sufficient activity to fly to the centres of attraction, and are most easily captured when the traps are set too closely (8 to 12 feet apart) for them to escape their action. Investigation has also demonstrated that the type of vessel used to contain the bait influences the proportion of the sexes captured; a vessel which admits of only a small surface of liquid, and of which the walls are considerably sloped is found to capture more females in proportion to the number of males than one with straighter sides and a larger surface of liquid. This is probably accounted for by the greater agility of the males and the attitude in which they alight on the surface of the liquid, all of which conditions facilitate their escape when this is at all possible.

Capus (J.). **L'Effeuillage. Moyen de Défense contre les Parasites de la Vigne.** [Defoliation. A defensive Measure against Vine Pests.]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux,* xv, nos. 11–12, November-December 1916, pp, 118–122.

The object of all processes in cultivation which are directed against animal and fungus pests of the vine is to give air to the inflorescences. This is done in four ways : by pruning, by tying up, by cutting back, and by defoliation. Both of the last two methods result in a loss of leaves to the plant. It is a well-known fact that certain hydrocarbons, chiefly starch and glucose, can only be produced by the presence of leaves, but a more important consideration is whether the leaves supply reserves to the plant from the commencement of their growth. Experience has shown that the process of cutting back a vine, although it destroys many leaves, does not cause any diminution in the quality or quantity of the crop, provided that the leaves thus cut are undeveloped and the branches unripe and that sufficient leaves be left to accomplish their physiological functions. The flowers or fruit of the vine are naturally hidden under the foliage, but an insecticide can obviously have no power over insects which it does not touch, and the removal of a few leaves, at the moment when the young branches are nailed or tied into position, will uncover the grapes and expose them to the sprays used against *Clysia ambiguella* and *Polychrosis botrana.* These moths occur chiefly on sheltered grapes, and those that are exposed to the sun during the period of oviposition are always less severely attacked. Experience has shown that defence against these pests is impossible without preliminary defoliation, but that it must be done at the moment when the inflorescences are formed and before the leaves removed are fully-grown. A second defoliation is recommended if the fruit again becomes hidden by the development of the leaves ; this gradual exposure prevents the grapes from being dried up by the sun. As a rule, grapes should only be exposed during the heat of summer, on the side furthest from the sun's rays.

Sur la Résistance des Chenilles à l'action du Froid. [On the Resistance of Caterpillars to the Action of Cold.]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux,* xv, nos. 11–12, November-December 1916, pp. 126–127.

Experiments have frequently demonstrated the remarkable resistance to cold of various Lepidopterous larvae, which can endure a temperature many degrees below freezing point and recover without apparent injury. Recent investigations have shown that this power of resistance to cold varies according to the season and experiments conducted in the spring have given contrary results, low temperatures invariably causing the death of the larvae.

Vaysière (A.). **Degâts occasionés par le *Sirex gigas,* L., [Hym.] dans l'Installation des Chambres de Plomb d'une Usine du Midi de la France.** [Damage occasioned by *Sirex gigas,* L., [Hym.] in the Lead-chamber Plant in a Factory in the South of France.]—*Bull. Soc. Entom. France, Paris,* no. 17, 8th November 1916, pp. 273-274. [Received 3rd January 1917.]

A recent case of the larvae of *Sirex gigas,* L., boring their way through the sheets of lead used in a factory belonging to the Chemical Produce

Company of Marseilles is recorded. When the lead tanks were tested, they were found to have been perforated by this sawfly, the larvae of which were living in the wooden casing. On examination, rough conical perforations were found in the lead, showing that the metal had been torn away piecemeal, and that it is therefore the imago and not the larva that does the damage. As the larval stage lasts two or three years, the damage may continue for a year or two, but would then stop because the insects would be killed by the acid fumes on emergence. The necessity for using in such installations wood that has been previously treated is thus emphasised.

NAVARRO (L.). **Parásitos animales de los Arboles frutales.** [Animal Pests of Fruit-trees.]—*Bol. Agric. Técnica y Económica, Madrid,* vii, no. 78, 30th June 1915, pp. 554–563. [Received 11th January 1917.]

The insect pests recorded on fruit-trees in Spain include :—Coleoptera: *Hylesinus oleiperda*, F.; *Rhynchites bacchus*, L., controlled by collection of damaged fruit, and winter digging at the foot of the trees in order to expose the pupae; *Peritelus griseus*, L., the larvae of which can be destroyed by injections of bi-sulphide of carbon in clay soils; *Otiorrhynchus cribricollis*, Gyl.; *Anthonomus pomorum*, L., and *A. rectirostris*, L., for which sprays of milk of lime and solutions of sulphate of iron are recommended; *Balaninus nucum*, L., against which prolonged irrigation in the winter and trenching round the trees are the methods of control suggested.

Lepidopterous pests, which are of less importance, include:—*Aporia crataegi*, L., *Lymantria dispar*, L., *Euproctis chrysorrhoea*, L., *Odonestis pruni*, L., *Malacosoma neustria*, L., and *Saturnia pyri*, L.

BENAIGES (C.). **Regeneración del Olivar.** [Redevelopment of the Olive Plantations.]—*Bol. Agric. Técnica y Económica, Madrid,* vii, nos. 79 & 80, 31st July & 31st August 1915, pp. 657–666 & 743–752. [Received 11th January 1917.]

A detailed description of *Saissetia* (*Lecanium*) *oleae*, a serious pest of the olive, is given. The Chalcid parasite, *Scutellista cyanea*, has been introduced against it with great success. Spraying should be carried out from the end of May to mid-June, and experience shows that two sprayings with weak solutions give better results than one which is more concentrated. A good formula is an emulsion of 4 lb. soft soap to $1\frac{1}{2}$ pints essence of turpentine, and Bordeaux mixture, 4 lb. sulphate of copper and 2 lb. fine fat lime to 18 gallons of water. This is both cheap and effective.

For the destruction of the Scolytid, *Phloeotribus scarabaeoides* (*oleae*), fumigations of hydrocyanic acid are recommended, and as one spring female may give rise to as many as 20,000 individuals, winter fumigation is very necessary. Details of the method of fumigation are given. Should this prove impracticable, in February and March the trees should be cleansed and then shaken; in June, when colonies of pupae hide in the crevices of the bark, the trunks should be scraped and then sprayed. Arsenic sprays are very effective if used just before the periods of activity of the insects, *i.e.*, during the larval and adult stages. These periods vary according to climate, and spraying

should be continued for about 10 days during each cycle. The formula recommended is anhydrous sodium arsenate, 14 oz.; lead acetate in crystals, $2\frac{3}{4}$ lb.; water, 20 gals. The acetate must be dissolved separately in 2 gals. of water and added slowly to the sodium arsenate, which has also been dissolved in 2 gals. of water; this must never be done in the reverse order. The quantity of lead acetate required differs according to the temperature of the water and other materials and should be determined exactly by an indicator paper, prepared by submerging slips of unsized paper in a 10 per cent. solution of potassium iodide and allowing them to dry. When the paper turns yellow, there is sufficient acetate present. This spray should never be used later than August.

PHILANTHOS (—). **Il melo** (*Pyrus malus*, **L.**). [The Apple Tree.]—*Riv. Agric., Parma,* xxii, no. 51, 22nd December 1916, pp. 778–779.

The usual controls for *Eriosoma lanigerum* are advised, including the application of a commercial oil varnish consisting of a mixture of 75 parts of linseed oil, 15 of white lead, and 10 of zinc oxide, which is boiled for 10 minutes, and, after it has cooled, has 10 parts of turpentine spirit added to it.

NININGER (H. H.). **Studies in the Life-Histories of two Carpenter Bees of California, with Notes on certain Parasites.**—*Jl. Entom. and Zool., Claremont, Cal.*, viii, no. 4, December 1916, pp. 158–166, 2 plates.

Xylocopa orpifex, Smith, was kept under systematic observation for a period of one year from 29th September 1915. The colony chosen for study was situated at an altitude of 3,500 feet at the top of a small mountain. This insect shows a decided preference for redwood (*Sequoia*), but has been found on one or two occasions in Oregon pine. It is always found in sound wood, showing no inclination for decaying timber. Its method of boring into the timber is described, as well as its life-history. It is parasitised by the Bombyliid, *Spongostylum delila*, Lw., which is found as a very minute, but exceedingly active, larva on the food-mass prepared by the female bee and on which it lays its egg. Other parasites of *H. orpifex* are a Phycitid moth and a Tenebrionid beetle (*Aphanotus brevicornis*, Lec.). Mites of the genus *Trichotarsus* infested a few nests and in some cases destroyed developing bees, though the emerging adult often carried them away among the hairs covering the thorax and seemed to be uninjured.

Xylocopa varipuncta, Patton, is larger than *X. orpifex*. It inhabits the valleys and lower hill regions. It seems to prefer partly decayed wood, and is found most abundantly on live oak, pepper and eucalyptus trees. In making its tunnels it follows the grain of the wood, while *X. orpifex* makes perfectly straight tunnels irrespective of the course of the grain. The only parasite of this bee found was the *Trichotarsus* mite, which destroyed a small percentage of larvae.

X. orpifex occurs from Arizona and Nevada southwards to Lower California, and *X. varipuncta* in Texas, Arizona, and Lower California, but not in New Mexico.

Weiss (H. B.). **Some unusual Orchid Insects. (Hem., Lep., Dip., Col.).** *Entom. News, Philadelphia,* xxviii, no. 1, January 1917, pp. 24–29.

In New Jersey greenhouses the following have been found attacking various orchids, having in all probability been introduced from Central and South America :—Rhynchota : *Tenthecoris bicolor,* Scott ; Lepidoptera : *Castnia therapon,* Koll. ; Diptera : *Parallelodiplosis cattleyae,* Moll. ; Coleoptera : *Eucactophagus graphipterus,* Champ. ; *Acythopeus* (*Baridius*) *orchivora,* Blackb. ; *Diorymellus laevimargo,* Champ. ; *Cholus cattleyae,* Champ. ; and *Diaxenes dendrobii,* Gahan.

Ripley (L. B.). **Notes on the Feeding Habits of Adult Chrysopidae (Neur.).**—*Entom. News, Philadelphia,* xxviii, no. 1, January 1917, pp. 35–37.

The author's experiments have proved the fallacy of the generally accepted statement that adult Chrysopids do not feed. When large scarlet Aphids, taken from the stems of *Rudbeckia laciniata,* were placed in a cage containing *C. oculata,* they were vigorously attacked and devoured by the Chrysopids, which also drank from drops of water. Unfed females kept in a cage were observed to extract eggs from their own abdomens with their mandibles and devour them rapidly, one after another. This method is apparently resorted to only under the stimulus of hunger and the rate at which eggs are available for extraction is not sufficient for their entire nutriment. After a few days without food, females die of starvation with many eggs in the abdomen, whereas fed females lay all, or nearly all their eggs.

Luginbill (P.) & Urbahns (T. D.). **The Spike-horned Leaf-miner, an Enemy of Grains and Grasses.**—*U. S. Dept. Agric., Washington, D.C., Bull.* no. 432, 13th December 1916, 20 pp. 2 plates, 1 fig.

The Agromyzid, *Cerodonta dorsalis,* Lw., breeds in a large variety of food-plants of the order Graminaceae. The synonymy and history, with a full description of the insect, are given. The female punctures the leaves of plants, feeding on the sap that escapes from the wound, and depositing eggs in the holes thus made. The greatest injury is done by the larvae, which mine the leaves and stems of young plants. Pupation takes place in the mines, whence the adult escapes through the dry tissue around the pupal case. The species is active throughout the year, fresh broods constantly appearing and overlapping previous generations ; rearing experiments have disclosed at least eight generations in a year. There are many natural enemies of this leaf-miner, which are probably the cause of the almost total disappearance of the pest during midsummer in some localities. These include :—The Hymenopterous parasites, *Cirrospilus flavoviridis,* Cwfd. ; *Cyrtogaster occidentalis,* Ashm. ; *Diaulinus websteri,* Cwfd. ; *Diaulinopsis callichroma,* Cwfd. ; *Polycystus foersteri,* Cwfd. ; a new species of *Dacnusa* ; *Chrysocharis parksi,* Cwfd. ; *Opius dimidiatus,* Ashm. ; and *O. aridus,* Gahan. Many of these are also parasitic on various species of *Agromyza,* especially *A.* ***pusilla.*** Preventive measures suggested are summer fallowing to destroy puparia remaining in dry

leaves, autumn ploughing to destroy larvae and pupae in remaining stems and leaves, and burning dry grasses along fences and roadsides in late autumn and early spring.

A bibliography of 14 works is given.

Pole Evans (J. B.). **The Causes of the Failure of Locust Fungus.** [Extract from the Presidential Adress, Section C, of the Report of the South African Association for the Advancement of Science.]—*South African Jl. Science, Cape Town*, xiii, no. 3, October 1916, p. 100. [Received 15th January 1917.]

It is stated that the author's investigations have disclosed the fact that the cultivated locust fungus which has for years been distributed among the farmers of Cape Colony and Natal is not *Empusa grylli*, Fres., which causes locust disease, but a species of *Mucor* which experiments have shown to be quite innocuous to the insects.

Webster (R. L.). **Potato Insects.**—*Iowa State Coll. Agric. Expt. Sta., Ames*, Bull. no. 155, May 1915, pp. 359–420, 43 figs. [Received 17th January 1917.]

Those pests which attack the foliage of potatoes include:—The Colorado potato beetle (*Leptinotarsa decemlineata*, Say), which is preyed upon by a bug, *Podisus maculiventris*, and its eggs eaten by the Coccinellid, *Hippodamia convergens*; the potato flea-beetle (*Epitrix cucumeris*, Harr.), which also attacks the common nightshade (*Solanum nigrum*); the blister beetles (*Epicauta vittata*, F., *E. cinerea*, Forst., and *E. pennsylvanica*, De G.); the Sphingids, *Protoparce* (*Phlegethontius*) *quinquemaculata*, Haw., and *P. sexta*, Joh., of which the latter is parasitised by a Braconid, *Apanteles congregatus*, Say, and two secondary parasites, *Mesochorus aprilinus* and *Hypopteromalus viridescens*; the cabbage looper, *Phytometra* (*Autographa*) *brassicae*, Ril.; the variegated cutworm, *Lycophotia* (*Peridroma*) *margaritosa* Haw.; and the cotton cutworm (*Prodenia ornithogalli*, Guen.).

Those which suck the sap from the foliage are:—The apple leaf-hopper (*Empoasca mali*, Le B.), which is preyed upon by the larvae of the lacewing flies and by *Triphleps insidiosus*; the potato Aphid (*Macrosiphum solanifolii*, Ashm.), which has also been recorded on cultivated iris and gladiolus, as well as on peas, shepherd's purse, and two species of wild ground cherry (*Physalis*) and is preyed upon by the Coccinellid, *Hippodamia convergens*, and parasitised by *Aphidius polygonaphis*, Fitch; the dusky leaf-bug (*Adelphocoris rapidus*, Say); the tarnished plant bug (*Lygus pratensis*, L.).

The potato stalk weevil (*Trichobaris trinotata*, Say) attacks the stalks and also infests the ground cherry (*Physalis pubescens*) and may be found on egg-plant (*Solanum melongena*), horse nettle (*S. carolinense*), bull nettle (*S. rostratum*), jimson weed (*Datura stramonium*), purple thorn apple (*D. tatula*) and cockleburr (*Xanthium canadense*). White grubs (*Lachnosterna* spp.) attack the roots and tubers.

The control measures in general practice are reviewed. Formulae for using lead arsenate in paste or powder, Paris green, kerosene emulsion, soap solutions, Black Leaf 40, poisoned baits and Bordeaux mixture are given.

A bibliography of 73 references is appended.

Webster (R. L.). **Two Strawberry Slugs.**—*Iowa State Coll. Agric. Expt. Sta., Ames,* Bull. no. 162, November 1915, 19 pp. 11 figs. [Received 17th January 1917.]

The habits of *Empria fragaria,* Rohwer, and *E. maculata,* Norton, are described. The former usually appears before the fruit is ripe and the latter after this. These sawflies do similar damage to the plants, eating out more or less irregular holes in the foliage. *E. fragaria* may be controlled by spraying with lead arsenate paste 2 lb. to 50 U.S. ($42\frac{1}{2}$ Imp.) gals. of water, or zinc arsenite 1 lb. to 100 U.S. (85 Imp.) gals. of water. Both are effective and should be applied immediately before blossoming. *E. maculata* has not been common enough to justify any trial spraying experiments. Arsenical sprays cannot be used on account of its being present after the fruit has set; should a control measure be necessary, an application of hellebore, which must be fresh, is suggested. *E. fragaria* has only been noted on strawberries, but *E. maculata* has been found attacking raspberries and also on *Potentilla canadensis.* Besides being distributed generally throughout Iowa, the former has also been recorded in Illinois and Missouri, while the latter has been found widely distributed throughout the eastern part of North America, Ontario, Saskatchewan, Indiana, Illinois and Missouri.

A bibliography of 30 references is given.

Webster (R. L.). **The Hessian Fly.**—*Iowa State Coll. Agric. Expt. Sta., Ames,* Circular 22 (Revised), July 1915, 44 pp., 6 figs. [Received 17th January 1917.]

The Hessian fly (*Mayetiola destructor,* Say) is dealt with briefly in this circular. It is more prevalent in the southern half of the State than in the northern. It infests wheat, rye and barley, and certain wild grasses to a slight extent. The control measures recommended are those which have already been advised for this insect [see this *Review,* Ser. A, iii, p. 416].

Webster (R. L.). **Common Corn Insects.**—*Iowa State Coll. Agric. Expt. Sta., Ames,* Circular no. 23, June 1915, 16 pp., 15 figs. [Received 17th January 1917.]

Recommendations for the control of the following pests of maize are given:—The common wheat wire-worm (*Agriotes mancus,* Say); *Melanotus* spp.; corn root aphis (*Aphis maidiradicis,* Forbes); northern corn root-worm (*Diabrotica longicornis,* Say); southern corn root-worm (*D. duodecimpunctata,* Oliv.); white grubs (*Lachnosterna* spp.); corn bill-bugs (*Sphenophorus* spp.); cutworms; chinch bug (*Blissus leucopterus,* Say); and the corn ear worm (*Heliothis obsoleta,* F.).

Solomons (C. C.). *Cassia nodosa* **tree defoliated by Caterpillars of** *Catopsilia pomona,* **F.**—*Spolia Zeylanica, Colombo,* x, no. 38, November 1916, p. 281. [Received 18th January 1917.]

A severe infestation of certain trees in Victoria Park by caterpillars of *Catopsilia pomona,* F., in enormous numbers is recorded. They were devoured wholesale by crows (*Corvus splendens*), which materially helped to control the damage that would otherwise have been done.

HENRY (G. M.). *Cassia nodosa* **Tree defoliated by Caterpillars of** *Catopsilia*, **F.**—*Spolia Zeylanica, Colombo*, x, no. 38, November 1916, pp. 281–282. [Received 18th January 1917.]

A similar incident to that described above, took place at the Royal Botanic Gardens at Peradeniya early in 1916. No birds were observed to be eating the caterpillars, though during an outbreak in 1914 king crows (*Dicrurus leucopygialis*) fed eagerly on the pupae. The damage done was only local and no permanent injury to the trees was effected.

ROEPKE (W.). **Wetenschappelik Onderzoek.** [Scientific Research.]—*Meded. Proefs. Midden-Java, Batavia*, no. 23, 1916, pp. 16–29.

This report covers the year 1915–1916. The Cantharid, *Epicauta ruficeps*, Ill., is common in eastern Java and parasitises the eggs of locusts. During the year locusts occurred on most estates and also beyond the range of the teak forests, so that new secondary foci were found, though infestation was usually unimportant. It was remarkable that the *Mylabris* beetles were less numerous than in the preceding year; this may be due to the larvae being controlled by parasites. *Helopeltis* occurred together with various ants and with the white cacao scales (*Pseudococcus crotonis* and *P. citri*). Among the new food-plants of *Helopeltis* noted were *Inocarpus edulis* and *Eryngium foetidum.* The bark-beetle attacking cacao appears to be distinct from *Xyleborus coffeae.* Work was continued on two previously reported species closely allied to the cacao moth (*Acrocercops cramerella*) and on the parasites of the latter. The Hepialid borer, *Phassus damor*, Moore, appeared on cacao. Advice was repeatedly given regarding a species of *Mudaria* boring in kapok. The occurrence of *Chrysomphalus dictyospermi* was reported.

Heer van der Goot's report, which is included, deals with a number of pests. The results of work on the gramang ant (*Plagiolepis longipes*) will be published shortly, but, meanwhile, it is stated that this ant has an extraordinary influence on the increase of the green coffee scale (*Coccus viridis*). The slight control exercised on this scale by Coccinellids is due to their slow development, slow increase and moderate feeding. The biology of the parasites of the green scale was further studied. The most common of them is the Chalcid, *Coccophagus* (*Encyrtus*) *bogoriensis*, Koningsb., but it is not prolific and its numbers are sometimes considerably reduced by hyperparasites, especially another Chalcid, *Myiocnema comperei*, Ashm.

A paper will shortly be published on the black cacao ant (*Dolichoderus bituberculatus*), the beneficial effects of which are considered proved. This useful insect must, however, be regarded as dangerous on coffee estates, as it favours the development of the green scale. In a series of experiments, repeated under constant conditions, the proportion of injury by *Helopeltis* to cacao plants, uninfested by ants, infested by gramang ants, and infested by black cacao ants, was as 100 to 40 to 5. The action of the black cacao ant does not lie so much in driving *Helopeltis* away as in disturbing it. It also favours the increase of the white cacao scale (*Pseudococcus crotonis*), and when this is abundant and covers the cacao pods, they are less

attacked by *Helopeltis*. *P. crotonis*, owing to the encouragement it gives to the black cacao ant, is of economic importance and the following biological notes are given :—The entire development takes about 40 days and there are two moults. The males are very scarce and always develop on the under-side of the leaves. In all its stages this scale is attacked by the orange-red larvae of a Cecidomyid (*Diplosis* sp. ?) which in its pupal stage is itself parasitised by a small black Proctrotrupid, as yet unidentified. No success attended attempts to pair *H. theivora* and *H. antonii* in captivity, though Dr. Roepke has noticed such pairing in the open. A solution containing 0·1 per cent. sodium arsenite and 2½ per cent. molasses was sprayed on small cacao plants. When applied in the morning, from 70 to 90 per cent. of the *Helopeltis* died, but as this spray seriously damaged the foliage, it cannot be employed in practice.

The beetle, *Araecerus fasciculatus*, appears to prefer the pods of *Tephrosia candida* and to be able to develop in them. Eggs also may be laid in the pods of *T. vogelei*, but they do not appear to develop. Besides *Crotalaria striata*, *Phaseolus radiatus* seems to be attacked, but only a small proportion of the eggs yield adults. In nature *Soja hispida* seems immune, nor does the beetle develop in other than growing Leguminous seeds. Ripe *Tephrosia* seeds, damp coffee beans, cacao beans, etc., are not attacked. The parasites obtained from infested *Tephrosia* pods included 2 Chalcids and 2 Braconids, which oviposit in the nearly mature beetle larvae. These parasites are sometimes present to the extent of 18–30 per cent. Direct control with Paris green only gave partial results. Attempts to populate the *Tephrosia* plants with black ants in order to drive away the beetle did not seem to be successful, and had the disadvantage of disturbing the parasites. The economic importance of this beetle, especially where *Tephrosia* seed is required, may be gauged by the fact that on one estate only 4–10 per cent. of sound seeds were found in the pods.

LEGISLATION.

Freeman (W. G.). **Plant Protection Ordinance.**—*Dept. Agric. Trinidad and Tobago, Rept. for the nine Months ended December 31, 1915, Port of Spain*, 1916, p. 14.

The pests proclaimed during the year were :—locusts, rhinoceros beetle (*Strategus aloeus*, L.) and gru-gru beetle (*Rhynchophorus palmarum*, L.). Seventeen notices relating to parasol ants (*Atta cephalotes*) were served during the year and 393 large nests destroyed on Crown lands. Several of the very badly infested areas have received careful attention. In some places collections of very large nests were found within a small area, indicating that for some years no efficient steps had been taken to destroy them.

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THE REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

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Milliken (F. B.). **The False Chinch-bug and Measures for Controlling it.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 762. 21st October 1916, 4 pp., 2 figs. [Received 24th January 1917.]

A severe outbreak of the false chinch-bug (*Nysius ericae*, Schill.) took place in Kansas and Colorado during May and June, 1916. The number of generations produced annually depends upon the temperature, the latitude and the season. At Garden City, Kansas, there are at least five. The adults of early spring and late autumn oviposit in the surface cracks of the soil. In the hottest weather this is effected in the flower-heads of various plants. The larvae feed almost exclusively on weeds, especially pepper grass (*Lepidium virginicum*), shepherd's purse (*Capsella bursa-pastoris*), thyme-leaved spurge (*Chamaesyce serpyllifolia*), Russian thistle (*Salsola tragus*), sage brush (*Artemisia tridentata*) and *Monolipis nuttalliana*. If drought prevails, the adults will attack cultivated crops, especially Crucifers, turnips or beets, and have been observed feeding on maize and kafir corn.

The control measures advised are: The destruction of the wild food-plants, preferably by burning, or by the use of a strong-blast gasoline torch. The torch used should be a powerful one costing £3 or £4. A spray of 1 lb. fish oil, or strong laundry soap, to 5 gals. water is effective when used on adults attacking cabbages or sugar beets. For turnips and radishes, 1 lb. of soap to 10 gals. water with 1 part nicotine sulphate to 1,000 parts of water may be used. For plants the resistance of which to soap solution is unknown, the latter spray should be used. A special type of sticky shield is described with a beater, on to which the adults may be driven. All remedies should be applied at the beginning of an attack.

Brown (K. B.). **The Specific Effects of certain Leaf-feeding Coccidae and Aphidae upon the Pines.**—*Ann. Entom. Soc. of America, Columbus, Ohio*, ix, no. 4, December 1916, pp. 414–421, 2 plates.

Chionaspis pinifoliae, Fitch, is a conspicuous and wide-spread pest of pines in North America and is particularly common on transplanted trees. In the eastern States, its most important host is the white pine, *Pinus strobus*, while it has done great damage to the Monterey pine, *Pinus radiata*, in California. It is entirely a leaf feeder, and is usually to be found on the flat surface of the needles, though in serious infestations it may also be found on the rounded surface. The amount of damage it does is in direct proportion to its numbers. The records for *Pinus radiata* in the Stanford arboretum indicate that approximately 5 per cent. of leaf-tissue is destroyed by this scale. This injury, added to that caused by other pests of the Monterey pine, such as *Diplosis pini-radiatae*, Snow, and *Physokermes insignicola*, Craw, so weaken the trees that they fall an easy prey to Scolytid beetles. The process by which *C. pinifoliae*, in common with other members of this family and of the Aphididae, uses its saliva to dissolve a passage through the hard cell-walls of the leaf is described.

Aspidiotus abietis, Schr. (the black hemlock or pine scab) is another Coccid of economic importance affecting Conifers and does great damage at times.

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Several species of Aphids infest pines, including *Lachnus piniradiatae*, Davids., and *Essigella californica*, Essig. The former is a sedentary species, often remaining in one position for weeks at a time. The attacked leaves become covered with a gray, waxy secretion and eventually a coating of black, sooty mould, which grows on the honey-dew secreted by the Aphids. *E. californica* is an active species which feeds for a day or two in one place and retreats to a protected position if disturbed or in wet, windy weather. Though the damage it does is inconspicuous, it is probably more important than all the above species together.

MASKEW (F.). **Quarantine Division, Report for the Month of October 1916.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, v, no. 12, December 1916, pp. 451–453.

The following pests were intercepted:—From Central America: *Aspidiotus cyanophylli* and *Pseudococcus* sp. on bananas, *Lepidosaphes gloveri* on limes. From China: Lepidopterous larvae in walnuts, *Cylas formicarius* in sweet potatoes, weevils in chestnuts. From Hawaii: *Diaspis bromeliae* and *Pseudococcus bromeliae* on pineapples, *Coccus longulus* on betel leaves, *Chrysomphalus aonidum*, *Lepidosaphes beckii* and *L. gloveri* on limes, *Chrysomphalus aonidum* and *Pseudococcus* sp. on bananas. From Holland: *Merodon equestris* in bulbs. From Japan: *Heterodera radicicola* in potatoes, *Pseudaonidia duplex* on camellia, *Tribolium castaneum* (*ferrugineum*) in ground rice, weevils in chestnuts. From Massachusetts: *Lepidosaphes ulmi* on twigs in barrels of cranberries. From Mexico: *Pseudococcus* sp. on crotons, *Chrysomphalus scutiformis* on oranges, *Lepidosaphes gloveri* on limes, *Calandra oryzae* in canary seed, *Calandra* sp. in tamarinds, unidentified Dipterous, Coleopterous and Lepidopterous larvae in dates. From New Zealand: Psyllids and Aphids on *Brachyglottis* sp., *Aspidiotus hederae* on palms, *A. rapax* (*camelliae*) and *Saissetia oleae* on *Diosma* sp., *Chionaspis* sp. on orchids. From Pennsylvania: a leaf-miner in Japanese iris, and *Aspidiotus hederae* on Kentia plants. From Venezuela: *Diaspis boisduvali* and *Isosoma orchidearum* on orchids. From Arizona: *Chrysomphalus aurantii* on oranges. From Arkansas: *Aleurodes* sp. on crape myrtle. From Florida: *Aleurodes* on shrubs and foliage. From Kansas: *Cydia pomonella* in apples. From New Jersey: *Chrysomphalus dictyospermi*, *Diaspis boisduvali*, *Saissetia hemisphaerica* and *Eucalymnatus perforatus* on orchids. From New York: *Aleurodes* sp. and *Parlatoria pergandii* on lemon plants, *Aspidiotus* sp. on orchids. From Oregon: *Rhizoctonia* on potatoes, *Lepidosaphes ulmi* and *Aspidiotus perniciosus* on apples. From Michigan: unidentified weevils in ornamental plants.

SMITH (H. S.) & BRANIGAN (E. J.). **On *Delphastus catalinae*, a valuable Ladybird Enemy of the Whiteflies.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, v, no. 12, December 1916, pp. 448–450, 4 figs.

Delphastus catalinae, Horn, having been found feeding on the whitefly, *Aleurodes kelloggi*, in California, the authors sent a colony to Florida as an experiment for the control of *Dialeurodes citri*, which is the worst insect pest of citrus fruit in that state. In the three

months since its introduction, this Coccinellid seems to have become thoroughly established and feeds freely on the eggs and young larvae of whiteflies, both in the adult and larval stages; it is therefore hoped that its introduction into Florida will prove valuable.

SNYDER (T. E.). **"White Ants" as Pests in the United States and Methods of Preventing their Damage.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 759, 9th October 1916, 20 pp., 14 figs. [Received 24th January 1917.]

The information concerning the life-cycle and habits of *Leucotermes flavipes*, Kollar, *L. virginicus*, Banks, and *L. lucifugus*, Rossi, has already been abstracted [see this *Review*, Ser. A, iii, p. 378, and iv, p. 181]. Extensive damage is caused by these termites to woodwork of buildings, as well as to living trees.

Stored material should be kept in a dry atmosphere, for once contact with the source of moisture, such as damp earth or wood, is cut off the insects depart or die. Temperatures over 160°F. will kill the insects. Living trees are difficult to protect, but care should be taken that they do not become scarred near the base. All débris, such as decaying wood, should be removed and, in vineyards, dead or diseased vines should be destroyed and pruned surfaces painted with coal tar. For flowers and greenhouse stock the use of less stable manure is advised, while liquid carbon bisulphide can be poured into small holes near infested plants, the hole being quickly closed with earth. A 5 per cent. kerosene-emulsion solution has also been found effective. For the protection of woodwork in buildings, wherever possible, the foundations should be constructed entirely of stone, brick or concrete, with basement pillars of stone supporting the floor above. Where stone or concrete foundations are impracticable, the timber used should be impregnated with coal-tar creosote. Necessary woodwork in greenhouses should be treated with bichloride of mercury.

For the elimination of termites already established in buildings, the point of entrance of the colony should be traced and, after removing the damaged wood, the ground should be soaked with kerosene and the damaged parts replaced by brick, concrete, or timber soaked in coal-tar creosote.

EHRHORN (E. M.). **Division of Plant Inspection.**—*Hawaiian Forester and Agriculturist*, xiii, no. 11, November 1916, pp. 399–401. [Received 24th January 1917.]

During the month, of 1,747 bags of beans from Japan, 389 were found infested with larvae of *Paralipsa modesta* (rice moth) and were fumigated with carbon bisulphide. Two large orchids on original stumps from the Philippine Islands were seized and destroyed by burning. On the limb of the tree on which the orchid was growing a wood-boring beetle was found under the bark and some Centipedes and a cockroach (*Polyzostera soror*) in the packing. *Pseudococcus citri* was intercepted on plants from New Jersey and New York. After fumigation, the pupa of the eastern tussock moth (*Hemerocampa leucostigma*) was also found.

Fullaway (D. T.). **Division of Entomology.**—*Hawaiian Forester and Agriculturist*, xiii, no. 11, November 1916, pp. 401–402. [Received 24th January 1917.]

During the month, 1,615 females and 1,015 males of *Opius fletcheri*, 1,800 *Tetrastichus*, 400 Chalcids and 387 *Diachasma tryoni* were liberated. The corn leaf-hopper egg-parasite is being propagated in the open and small numbers have been distributed.

Pests of Sugar-Cane in British Guiana.—*Agric. News, Barbados*, xv, nos. 382–383, 16th and 30th December 1916, pp. 410–411 & 426–427.

These notes review the reports for the years 1914 and 1915 by Mr. H. W. B. Moore, and deal with many of the same pests as those noted in a previous one [see this *Review*, Ser. A, ii, p. 57]. The small, black hard-back (*Dyscinetus bidentatus*) came into prominence in 1914, after the heavy rains, and caused 75 per cent. of the damage in the fields examined. This outbreak lasted into August; a second outbreak in December did only a small amount of damage. Two attacks occurred in 1915, the first in January on two estates, on one of which it was severe, and the second from April to the end of July, which was generally slight. Some details of the life-history and habits of this beetle are given. The larvae live in the earth about the cane stools, feeding almost entirely on soil containing decayed vegetable matter. They must be destroyed before they can develop into the destructive adults. The beetles are active at night, but hide in the day time. Two things are essential for the growth and development of this beetle, viz.: an abundant and long-continued supply of moisture and decaying vegetable matter. Where the larvae find the cane stools decayed or in poor condition, and the moisture conditions suitable, they are almost certain to cause serious damage to crops. The larva of the large moth borer (*Castnia licus*) is primarily the cause of the bad state of the cane stools, but poor or unsuitable soil and bad weather are also responsible. Among the decaying stools, besides the hard-back, may be found weevil borer larvae, stool moth larvae (*Acrolophus sacchari*), root scale (*Aspidiotus sacchari*) and wood ants.

The best protection against *D. bidentatus* lies in a vigorous condition of the cane stools and the control of stool-eating insects, such as *Castnia*, and more frequent replanting, as ratoons suffer most from this pest, are advised. Digging out of dead stools enables grubs to be collected in large numbers, and their exposure to sun and wind causes the destruction of many eggs. Replanting should not be carried out on land previously occupied by such grasses as arrow-grass (*Anatherum bicorne*) or razor-grass, the shoots of which are attacked by the hard-back in the same way as sugar-cane. Trap lights were tried in 1915, but were not successful; nor was the night collection of the adults with lanterns. *D. bidentatus* was parasitised in 1914 and 1915 by *Tiphia parallela*. Another Scoliid, *Dielis dorsata*, was also observed, though it is uncertain which species of hard-back it parasitises.

The smaller moth borers (*Diatraea saccharalis* and *D. canella*) are still the most important sugar-cane pests, in spite of the great collection

of egg-masses and caterpillars. The number of egg-masses collected increased from 180,000 in 1913 to over 500,000 in 1914 and over 812,000 in 1915, while the number of caterpillars dropped from 25,583,987 in 1913 to 20,882,042 in 1914 and 19,436,345 in 1915. New food-plants of these borers include:—*Paspalum gracile*, *P. virgatum* and other species of this genus which grow in moist situations, a sedge (*Cyperus* sp.) and another water grass, *Panicum elephantipes*. *D. saccharalis* has apparently a preference for more or less aquatic grasses, which points to the fact that wet weather may favour this borer in the cane-fields. It is also noted that the egg-clusters collected in dry weather were small and that these became normal in size as soon as the rains started. It is preyed upon, though not appreciably reduced in numbers, by a Stratiomyid fly, *Sargus* sp., a Carabid beetle larva and a pseudoscorpion. The reddish-black hard-back (*Lygyrus ebenus*) caused slight injury to cane stools both in 1914 and 1915. It was found only in certain fields adjacent to savannah lands covered with sedge (*Cyperus* sp.), one of its native food-plants. The frog-hopper (*Tomaspis flavilatera*) requires watching to prevent its becoming a serious pest. It is preyed upon by the larva of a Syrphid, *Salpingogaster nigra*, which also attacks this frog-hopper in Trinidad. *Aspidiotus sacchari* and *Orthezia praelonga* occurred in a few places, the former on poor stools, the latter on cane blades. The grass-looper, *Pelamia* (*Mocis*) *repanda*, and the rice worm (*Laphygma frugiperda*) did local damage, but a serious outbreak was prevented by the collecting of egg-clusters and hand-picking of caterpillars. The brown locust (*Schistocerca pallens*) was abundant on one estate in 1915, but was controlled by collecting. The green grasshopper (*Conocephaloides maxillosa*) also occurred, but was not important. A small brown Chrysomelid beetle (*Myochrous armatus*) was fairly plentiful on several estates in 1914, during the rainy season. These beetles hide in the earth, or in the young shoots in which they eat holes.

Degrully (L.). **Pour détruire les Cochenilles de la Vigne.** [How to destroy Scale-Insects on Vines.]—*Progrès Agric. Vitic., Montpellier*, xxxiv, no. 3, 21st January 1917, pp. 56–57.

The following formulae are given for treating vine stocks as a protection against scale-insects, after stripping and cleaning the bark:—Water 1 gal., black soap 20 oz. by weight, vegetable seed oil 20 oz. by weight, petroleum 10 oz. by weight. This must be carefully emulsified. Water 20 gals., tar 8 lb., fat lime in lumps 16 lb.; or water 20 gals., heavy coal oil 8 lb., fat lime in lumps 16 lb. For the preparation of the last two formulae, the lime is slowly slaked with water until a thick milk of lime is obtained, the tar or oil is then added gradually; when the mixture is homogeneous, sufficient water is added to make up the amount to 20 gals. If sooty fungus is present on the stems, the above treatment may be completed by spraying the vines with a 2 per cent. solution of copper sulphate.

FEYTAUD (J.). **Les Insectes de la Vigne. Le Sphinx** (*Sphinx elpenor*, **L.**). [Insects attacking Vines. The Hawk-moth (*Sphinx elpenor*, L.).] —*Rev. de Vitic., Paris,* xlvi, no. 1175, 4th January 1917, pp. 15–18, 1 plate.

In France several Sphingids in the larval stage attack vines, the one usually doing the most damage being *Pergesa elpenor.* It prefers vines on espaliers, as the neighbouring wall or woodwork affords shelter for larvae and pupae, and is less prevalent in open vineyards owing to the winter cultivation destroying many pupae. In summer, hand-picking the caterpillars and bait-traps for the adults, and in winter, hand-picking and destruction of the pupae while cultivating the soil, are the most effective measures.

SANDERS (J. G.). **Insect Damage to Pennsylvania Crops.**—*Weekly Press Bull., Penns. Dept. Agric., Harrisburg,* ii, no. 2, 11th January 1917.

The annual total damage done to crops in Pennsylvania is estimated at over £5,000,000. All agricultural crops are estimated at being damaged to 10 per cent. of their total value each year, while a very large additional sum is lost through improper handling or neglect of crops.

VASSILIEV (I. V.). **Мальвовый листоѣдъ-вредитель хлопчатника на Кавказѣ.** [A Chrysomelid Pest of Cotton-Plants in Caucasia.] —**« Кавказское Хозяйство.»** [*Caucasian Husbandry*], *Tiflis,* no. 17–18, 14–18th September 1916, pp. 12–13.

A new Chrysomelid pest of cotton was discovered by the author, in 1915, in the Government of Elisavetpol. The damage, which is confined to the leaves, was first observed at the end of June and had become serious by the latter half of July, continuing until the middle of September. The beetles also feed on plants of *Malva* and *Althea* growing near cotton fields. During the winter the adults were found hibernating in the soil. It is suggested that spraying with Paris green or barium chloride may be useful, as well as catching the beetles on sheets covered with an adhesive. The spraying should be started on the Malvaceous weeds, or, if possible, it would be better to destroy these altogether.

DONTCHEV (V. N.). **Плодовый садъ любителя.** [Amateur's Orchard.] —Supplement to **« Прогрессивное Садоводство и Огородничество.»** [*Progressive Fruit-Growing and Market-Gardening*], *Petrograd,* 1916, 128 pp., 92 figs.

One chapter of this book is devoted to the insect and fungus pests of orchards and deals with the life-histories of and remedies for: *Aporia crataegi, Euproctis* (*Porthesia*) *chrysorrhoea, Hyponomeuta malinellus, Cheimatobia brumata, Cydia pomonella, Anthonomus pomorum, Rhynchites bacchus, R. conicus, R. pauxillus, Melolontha, Epicometis* (*Tropinota*) *hirta, Psylla mali,* Aphids and other pests. A remedy given for *Melolontha* consists of manuring the soil round the roots, after the trees have been watered, with one or two ounces of saltpetre in March, May and August.

Ermakov (V.). **Радикальный способъ истребленія тлей.** [A radical method of destroying Aphids.]— **« Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, xv, no. 12, December 1916, pp. 654–656.

In accordance with his views on the importance of the relation between ants and Aphids [see this *Review*, Ser. A, iii, p. 486, iv, p. 381], the author suggests that the only thorough measure against the latter is to destroy the ants. For this purpose, he has previously recommended the use of a weak decoction of cow-dung; he has found that this liquid is quite harmless to the roots and that it also destroys mole-crickets. After he had destroyed the ants in his orchard, frost-bitten trees disappeared, and the opinion is expressed that the damage usually attributed to frost is due to a lack of uniformity of movement of sap in the trees, resulting from the presence of ants on the roots. Ants may also play a similar part in connection with *Phylloxera*, in which case the destruction of ant-hills in vineyards is indicated.

Dzengelevsky (P. I.). **Виноградный трубковертъ.** [*Byctiscus betulae*.]— **« Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, xv, no. 12, December 1916, pp. 662–663.

Byctiscus betulae (*Rhynchites betuleti*) occurs in large numbers in some vineyards of the province of Don. This weevil, which feeds on leaves of vine and many other plants, is principally injurious during the oviposition period, when the females gnaw the petioles of the leaves, causing them to wither. The measures against it include shaking the adults on to sheets, collecting and burning the infested leaves, and digging the soil late in autumn to destroy the hibernating beetles by exposing them to the cold.

Balkhozin. **Борьба съ муравьями.** [The Control of Ants.]— **« Русскій Пчеловодный Листокъ.»** [*The Russian Beekeeping Gazette*], *Moscow*, xxxi, no. 10–11, October-November 1916, pp. 372–373. [Received 5th January1917.]

Hyposulphate of soda is recommended as an effective and cheap remedy for keeping ants out of bee-hives. Small pieces of it should be placed in various corners of the hives which are inaccessible to the bees.

Rushkovsky (I. A.). **Энтомологическія изслѣдованія въ 1914 году.** [Entomological Investigations in 1914.]— **« Мѣропріятія Уфимскаго Губернскаго Земства по улучшенію сельскаго хозяйства въ 1914 году.»** [*Agricultural Improvement Measures of the Zemstvo of the Govt. of Ufa in 1914*], *Ufa*, 1914, pp. 31–34. [Received 8th January 1917.]

This is a short preliminary report on the investigations carried out by the author in 1914, in continuation of work done in the previous year [see this *Review*, Ser. A, 111, p. 480]. Grain fields in the government of Ufa are chiefly injured by insect pests in the spring, except in the case of wire-worms and caterpillars of *Euxoa segetis*, Schiff., which are present in many localities and do great damage to crops in the autumn. The chief spring pest during the year under report

was the larva of *Chaetocnema*, next to which came *Oscinella* (*Oscinis*) *frit*, which in the previous year had occupied the first place. The Hessian fly (*Mayetiola destructor*) was practically absent. *Contarinia tritici*, Kirby, is recorded as a new pest and proves to be widely spread. *Sitones* spp. and the caterpillars of *Cydia* (*Grapholitha*) *dorsana* injured peas and other leguminous plants. Linseed crops suffered seriously from *Aphthona euphorbiae*, F., and market-gardens from *Barathra* (*Mamestra*) *brassicae*, the caterpillars of which attacked cabbages, onions and other plants. Orchards were attacked by *Hyponomeuta malinellus*. *Lymantria* (*Ocneria*) *dispar* practically disappeared in the year under report, probably owing to parasites and fungus diseases. A fuller report is in contemplation.

KHARIN (I.). **Извлеченіе изъ отчета о дѣятельности Сызранскаго Отдѣла Импер. Росс. Общ. Плодоводства за 1916 годъ.** [Extract from the Report of the Syzran Branch (Govt. of Simbirsk) of the Russian Imperial Horticultural Society.]—**« Плодоводство.»** [*Fruit-Growing*], *Petrograd*, xxvii, no. 11, November 1916, pp. 462–464. [Received 5th January 1917.]

In the year under report the most serious pests of orchards were *Hyponomeuta malinellus*, *Cydia pomonella* and *Rhynchites auratus*; other species of *Rhynchites*, as well as *Aporia crataegi*, *Psylla* and *Euproctis chrysorrhoea*, were not numerous. The branch has organised lectures on horticulture for the benefit of the local population, has published pamphlets on the control of pests, and has also been instrumental in supplying the population with sprayers.

SEVASTIANOV (I. A.). **Наблюденія надъ яблочной плодожоркой.** [Observations on *Cydia pomonella*, L.]—**Часть I-ая. Естественная исторія плодожорки и методика ея изученія.** [Part I. The Natural History of the Pest and Methods of studying it.]—Published by the Turkestan Entomological Station, *Tashkent*, 1916, 161 pp., 4 diagrams.

This work, in which several assistants of the Station in addition to the author have been associated, is the result of observations extending over three years; a second part will be devoted to the control of this pest. In Russia, *Cydia pomonella* first attracted attention in 1840–50, when it was noticed in the Crimea and in the government of Petrograd; it is now prevalent throughout the whole region in which apples are cultivated. There is no doubt that it occurred in Turkestan before the arrival of the Russians and that it spread independently of the construction of railways. In addition to apples, it also breeds in pears and quinces and occasionally in apricots, cherries, peaches and plums.

Early varieties of apples suffer less than late ones, as they are only attacked by one generation, while the latter are injured by three in Turkestan. It appears to be certain that this moth hibernates in the larval stage only and that some individuals begin to do so as early as May. A number of tables dealing with the distribution in time of the various stages are given. Pupation in nature may begin as early as the middle or second half of February, caterpillars exposed to the sun's rays pupating earlier than those in more

shaded places. Pupation on the part of hibernating individuals is over by the middle of May and, as the season advances, the pupal stage becomes shorter, the minimum in spring being 16 days. The eggs are laid mainly on smooth spots exposed to the sun, rough or hairy parts being avoided. More eggs are laid on the fruits than on the foliage, especially in the case of varieties having rough leaves. After hatching, the caterpillars frequently make several attempts to enter the fruit before a suitable spot is discovered. The process of boring into the fruit, which is fully described, occupies some 50–55 minutes in apples and 25–30 minutes in apricots. Though the first generation of caterpillars usually enters the fruit through the calyx, it does not follow that this is the only way in which it can do so ; otherwise it would be necessary to attribute a different instinct to the next generation, which enters at the top of the pedicel or from the sides of the fruit. As a matter of fact, the caterpillars search for a protected spot to begin boring and find it, in the first instance, exclusively in the calyx. The life-history of the various stages of the caterpillars within the fruit are described in detail. After the third moult they exhibit a tendency to pass from one fruit to another, and in the fourth stage this may become compulsory, owing to the dropping of the infested fruits. At this time they are much subject to the attacks of predaceous enemies, though their parasites, such as the Ichneumon, *Hemiteles carpocapsae*, can reach them even in the seed of the fruit. When no other fruit is found, pupation may take place after the fifth or even the fourth moult, although this normally occurs after the sixth. The total duration of the larval stage varies between a minimum of 14 and a maximum of 20 days.

In discussing the number of generations of this moth, the author deplores the lack of any methodical observations on this point in Russia. The method adopted by him in Turkestan during 1913 and 1914 consisted of the use of trap belts, the captures from which provided material for the preparation of curves showing the number of caterpillars and adults collected at definite intervals. It appears certain that three generations occur in Turkestan. Besides wintering caterpillars, some adults were occasionally found during the winter months, though their numbers were hardly sufficient to render certain the existence of a fourth generation. The occurrence of a state of larval diapause is clearly established by the fact of a number of caterpillars of each generation remaining without further development over the winter. The factors that produce this are obscure, but a certain analogy can be drawn between this phenomenon and the polymorphism of certain insects, dependant on hereditary biological tendencies.

SIJAZOVA (A.). **Къ біологіи нѣкоторыхъ вредныхъ насѣкомыхъ Туркестанскаго края.** [On the Biology of some Insect Pests of Turkestan.]—Reprint from **«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, 1916, 15 pp.

The second instalment of this article [see this *Review*, Ser. A, iv, p. 493], which is contained in this complete reprint of the whole, deals with *Rhynchites auratus*, Scop., with special reference to the method of oviposition by the females. This process has been

differently described by various authors (N. Sokolov, A. Lebedev, J. Schreiner and N. Troitzky), but the observations of the author in 1915, extending over some 600 ovipositions into cherries and some 50 into apples, confirm the correctness of the views expressed by the last two as to the formation of the channel round the cylinder in the fruit containing the egg [see this *Review*, Ser. A, i, p. 439]. Less than 1 per cent. of the ovipositions examined had no such channel, while 10 per cent. showed an unfinished one and 89 per cent. possessed a normal, complete one. In wild cherries this channel is larger than in cultivated ones, its diameter reaching 4 mm. and its depth 2 mm, and in apples it is larger still, having a diameter of 6 mm. and a depth of 4–5 mm. It has further been confirmed that, as stated by N. Troitzky, the hole in the cylinder is filled with the excreta of the females and not by fragments of the fruit.

Shreiber (A. F.). **Наилучшіе методы борьбы съ земляными блошками.** [The best Remedies for the Control of *Phyllotreta.*]—**«Вѣстникъ Садоводства, Плодоводства и Огородничества.»** [*Messenger of Gardening, Fruit-Growing and Market-Gardening*], *Petrograd*, lvii, no. 7–8, July-August 1916, pp. 429–431. [Received 15th January 1917.]

Phyllotreta undulata, Kut., and *P. vittata*, F., do a great amount of damage every year to cabbages in the government of Irkutsk, Siberia ; in 1915 cauliflowers were specially attacked. Many of the numerous remedies suggested against these beetles, such as spraying with Paris green and powdering with ashes, lime and sawdust, have proved ineffective. Powdering with white or red, but not yellow, sand has proved to be the best. Various theories have been advanced to explain the effectiveness of sand ; the author believes that it is connected with the mechanical effect of the sharp quartz grains getting underneath the elytra of the beetles and damaging the wings. Only fine and dry sand should be used and the beds must be covered with a layer not less than 5 inches thick. The planting of tomatoes near beds of cabbages, radishes, etc., is also recommended, as the smell of these plants has a deterrent effect.

Sacharov (N.). **Нѣсколько словъ о дѣятельности прокантныхъ пунктовъ по борьбѣ съ вредителями садоводства.** [Some Remarks on the Work of the Apparatus-Hiring Depots for the Control of Pests of Horticulture.]—**« Земская Хроника Астраханской губерніи.»** [*The Chronicles of the Zemstvo of the Govt. of Astrachan*], *Astrachan*, i, no. 1, 1916, pp. 34–37.

The author describes the work of the apparatus-hiring depots established by the Entomological Stations in various parts of Astrachan during the years 1914–1916. In 1914 only one depot was in existence, this number having been increased to three in 1915 and to 11 in 1916 ; in 1917 three additional ones are proposed. The depots also sell various insecticides and fungicides. In 1916 over 500 acres of orchards and vineyards were sprayed through the medium of these depots.

Avdeiev (M.). **Хлопководство въ Закавказьѣ въ 1916 г.** [Cotton-growing in Transcaucasia in 1916].—**« Кавказское Хозяйство.»** [*Caucasian Husbandry*], *Tiflis*, no. 17–18, 14–28th September 1916, pp. 4–8.

The cotton boll worm (*Heliothis obsoleta*) has of late years done great damage to cotton plantations in the governments of Elisavetpol, Baku and Tiflis; in 1914 and 1915 it was responsible for a decrease in the harvest of 25–30 or even 50 per cent.

Журналъ перваго засѣданія комитета Донского бюро по борьбѣ съ вредителями сельскохозяйственныхъ растеній при Ростовскомъ на Дону Обществѣ Садоводства 22 Ноября 1916 года. [Minutes of the Proceedings of the First Meeting of the Committee of the Don Bureau for the Control of Pests on 22nd November 1916.]—**«Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, xv, no. 12, December 1916, pp. 689–695.

The budget of the Don Bureau for the control of pests during 1915–16 amounted to about £900 assigned by the Department of Agriculture and over £700 assigned by the Provincial Military Authority. In 1917 the expenses are estimated to exceed £3,000, about half of which sum is to cover the salaries of the staff of the Entomological and Phytopathological Sections of the Bureau. E. V. Zvierezomb-Zubrovsky has been appointed Director of the Entomological Section and Miss A. V. Shamrai his assistant. A discussion on the objects and work of the new Bureau resulted in a decision to allow the staff a free hand in deciding the scope of their work.

Mokrzecki (S. A.) & Bragina (A. P.). **О лабораторномъ разведеніи яйцеѣдовъ** *Trichogramma semblidis*, Aur., **и** *Trichogramma fasciatum*, P., **и температурные опыты надъ ними.** [The Rearing of *Trichogramma semblidis*, Aur., and *T. fasciatum*, P. in the Laboratory and Temperature Experiments on them.]—Published by the Salgir Experimental Pomological Station at Simferopol, *Simferopol*, 1916, 13 pp., 4 figs.

Trichogramma fasciatum, Perk., is seldom found in orchards in the Crimea; of 50 eggs of *Cydia pomonella* collected in 1912 none were infested with this parasite, while in 1913 only 2 per cent. proved to be infested. *T. semblidis*, Aur., is more common and in 1914 this parasite infested a considerable number of eggs of *Barathra* (*Mamestra*) *brassicae.* The experiments on the artificial rearing of these parasites in the laboratory were begun on the eggs of *Cydia pomonella*, but owing to the limited number of these which were available, it was found necessary to make use of the eggs of many other Lepidoptera, as well as eggs removed artificially from the ovaries, before oviposition, which also proved quite suitable. Female butterflies and moths caught on fermenting molasses were kept in small glasses, the inside of which was lined with paper, placed upside down on a piece of paper. The eggs were transferred, by cutting out small pieces of the paper on which they were deposited to small test-tubes; from 3 to 10 eggs were placed in each tube together with one or two parasites, as it was discovered that the latter live longer if kept isolated. As the numbers of insects caught

on molasses or otherwise was greater in spring and at the end of the summer, it was found advisable to preserve their eggs in a refrigerator at a temperature of 40–42°F. so as to delay their further development. When required, they were removed from the ice and offered to the parasites. In winter these eggs were kept between the frames of double windows where, if not exposed to the sun, they would remain till the middle of March, when it is possible to procure freshly laid eggs in the Crimea. In the laboratory these parasites infested eggs of a great variety of Lepidoptera, including *Barathra brassicae*, *Polia oleracea*, *Agrotis pronuba*, *Hadena* (*Trachea*) *atriplicis*, *Oria* (*Tapinostola*) *musculosa*, *Feltia* (*Agrotis*) *exclamationis*, *Zygaena sp.*, *Acronycta rumicis*, *A. tridens*, *Papilio podalirius*, *Catocala sp.*, *Hibernia defoliaria*, *Euproctis* (*Porthesia*) *chrysorrhoea*, *Spilosoma sp.*, *Procris* (*Ino*) *ampelophaga*, *Phlyctaenodes* (*Botys*) *sticticalis* and *Cheimatobia brumata*, besides many unidentified species. It is therefore considered certain that they infest eggs of practically all Lepidoptera, except some eggs which are too small, such as those of the TINEIDAE, or those with a hard shell, such as *Lymantria dispar* or silkworms. The number of parasites which it is possible to rear in the laboratory is theoretically unlimited; when proper care is taken of the parasite, it can live 17–19 or even 22 days and deposit up to 50 eggs. The first specimen of *T. fasciatum* was reared in July 1913, and since that date, up to the time of the appearance of the report in 1916, 50 generations have been bred from it. No males were observed during the whole of this time. Of each generation only about 5 individuals give rise to descendants under laboratory conditions.

Experiments were also conducted on the effects of temperature on these parasites, and, from a table given, it appears that at a temperature of 38–39°F. hibernation sets in, while at 48–52°F. development lasts 38–43 days; at higher temperatures the time necessary for development decreases, being 10 days at 84°F. and 8–9 days at 88–100°F., while 95–100°F. is fatal to the adults, though it is probable that in nature they are able to survive even higher temperatures. Although no parasites hibernating in the eggs of the host were found under natural conditions, it is thought from the experiments that this may occur; when the eggs of *Catocala* sp. were infested in October and kept over the winter at 39°F., they gave rise to parasites in February; in another experiment eggs of the same insect were infested in September and kept in a refrigerator till the middle of the following June, and when brought into a normal temperature, they produced parasites.

The results of these experiments tend to show that it is practicable to rear these parasites artificially in any numbers and to keep them for many months. Further experiments are required to demonstrate how far they can be utilised for the practical control of *Cydia pomonella*.

MOKRZECKI (S. A.). **Салгирская Помологическая Станція. Краткій очеркъ ея дѣятельности за 1913-1915 организаціонные годы.** [A short Review of the Work of the Salgir Pomological Station at Simferopol for 1913–1915], *Simferopol*, 1916, 40 pp., 20 figs.

The Pomological Station at Salgir in Simferopol, which was opened at the beginning of 1913, has an Entomological Section, which deals with the study of the biology of insect pests and the methods of

their control, as well as the training of entomologists. A prominent place has been occupied by investigations into the control of pests by means of parasites [see this *Review*, Ser. A, iii, p. 613], although the author does not share the general great expectations connected with this method [see this *Review*, Ser. A, i, p. 363]. Experiments were also carried out on the effects of various insecticides on the caterpillars of *Lymantria dispar*, and it was found that the fifth and sixth stages are not affected by sodium arsenate or by azurgin (a solution of Paris green in sal-ammoniac), while a 3 per cent. solution of barium chloride with molasses destroys in hot weather up to 64 per cent., Paris green (4 grms. with 8 grms. of lime in 100cc. of water), 86 per cent., and lead arsenate, 70 per cent. of the caterpillars.

Attention was also paid to the study of *Eucosma* (*Tmetocera*) *ocellana*, *Argyroploce* (*Olethreutes*) *variegana*, Hb., *Tortrix* (*Cacoecia*) *podana*, Scop., *Recurvaria nanella*, Hb., *Chloroclystis rectangulata*, L., *Acrobasis obtusella*, Hb. and *Olethreutes achatana*, F. The following insects were also observed on fruit trees : *Tortrix* (*Pandemis*) *corylana*, F., *T.* (*P.*) *heparana*, Schiff., *Oxygrapha* (*Acalla*) *variegana*, Schiff., *Tortrix* (*Cacoecia*) *crataegana*, Hb., *T.* (*C.*) *lecheana*, *Coleophora anatipenella*, Hb., *C. gryphipenella*, Bch., *Tortrix laevigana*, *Hypsilophus* (*Cerostoma*) *persicellus*, F., and *Trachoma* (*C.*) *horidellum*, F.

In 1915 one generation of *Psylla pyrisuga*, Först., occurred while there were two of *P. melanoneura*, Först., and *P. albipes*, Flor. All three species hibernate in the adult stage in groups on the trunks of pear trees. *P. melanoneura* oviposits in the first half of March on branches of pear trees, the first larvae appearing at the end of that month ; *P. pyrisuga* oviposits at the end of March on buds. The local species of *Psylla* infesting apples is clearly distinct from the central European, *P. mali*, L. ; it hibernates in the adult stage on apple trees and oviposits in spring on the leaves ; though only one generation occurs, the numbers of this pest have recently increased yearly.

A new pest in the Crimea, *Aleurodes bragini*, Mokr., was observed in 1914, when it attacked and injured leaves of young pear trees ; owing to the presence of parasites and to the frosts in autumn, it practically disappeared in 1915 ; the life-history of this pest will be more fully described in a separate paper.

Besides *Aphis pomi*, De G., another, apparently new, Aphid was observed on apples ; it gives rise to red galls on the leaves and migrates to medlars, thus resembling *A. crataegi*, Kalt. The Chalcid, *Syntomaspis pubescens*, the observations on which were completed in 1915, deposits its egg by means of a long ovipositor near the seed of the young ovary of the apple-fruit. The larva on hatching out penetrates into the soft seed, in which it lives ; it becomes mature in July and hibernates in that stage ; in the middle of the following April it pupates, the adult appearing in about a month's time through a hole gnawed in the wall of the seed. It can emerge only in cases where the fruit has already rotted.

Other insects studied at the Station were : *Procris* (*Ino*) *ampelophaga*, L., *Emphytus truncatus*, Kl., *Anthonomus pedicularius*, L., and the following pests of stored grain, flour, etc. :—*Calandra granaria*, L., *Bruchus pisorum*, L., *Tenebroides* (*Trogosita*) *mauritanica*, L., *Tenebrio molitor*, L., *Silvanus surinamensis*, L., *Sitodrepa panicea*,

L., *Palorus* (*Caenorse*) *depressa*, F., *Tribolium madens*, Charp., *Laemophlaeus* sp., *Ephestia kühniella*, Zell., *E. elutella*, Hb., and *Asopia farinalis*. Disinfection with sulphur dioxide proved effective against these pests, and in the case of *E. elutella*, the gas produced by burning 3 oz. of sulphur for each 50 cubic feet of space is sufficient to destroy this moth in 24 hours.

Mokrzecki (S. A.). **Грушевый цвѣтоѣдъ въ Бессарабіи.** [*Anthonomus pedicularius*, L., in Bessarabia.]—Published by the Salgir Experimental Pomological Station at Simferopol, *Kishinev*, 1916, 8 pp., 4 figs.

Some account is given of *Anthonomus pedicularius*, L., from material sent from Bessarabia. The larvae of this weevil, which, as well as the other stages, are described and figured, were found inside buds of pears. The larva devours the lower part of both the flower and leaf-buds, eating through the fibro-vescular bundles and thus destroying the future shoot, and is therefore even more injurious than *A. pomorum*, L., which injures only a single flower-bud. In April the larvae become mature and the pupal stage lasts 15 or 16 days, the adults appearing in Bessarabia in the second half of May. Two parasites, *Pimpla pomorum*, Ratz., and *Pteromalus* sp., which also attack *A. pomorum*, were reared from the larvae and pupae. The adults oviposit in autumn, one egg being deposited in each bud ; hibernation takes place either as an egg or a young larva.

The damage done by this pest in Bessarabia is very great. The remedies suggested are : spraying the buds in autumn with Paris green and lime (1 lb. of lime, 3 lb. of quick lime in 165–170 gallons of water) or lead arsenate (1 lb. in 40–45 gallons, potato-molasses being added for adhesive purposes) and collection of the infested buds in spring, when they can be clearly recognised, and the shaking down of the weevils when feeding on the pears.

Bragina (A. P.). **Клубничный пилильщикъ.** [*Emphytus truncatus*, Kl.]—Published by the Salgir Experimental Pomological Station at Simferopol, *Simferopol*, 1916, 7 pp. 10 figs.

The sawfly, *Emphytus truncatus*, Kl., does not occur in the Crimea and the specimens, the laboratory observations on which are described in this article, were collected in the larval stage in the forests of Berdiansk on strawberries in June 1913. They begin to oviposit immediately after emerging from the pupa and before pairing, such eggs producing only males ; the fact however that both sexes were reared from the material collected suggests that pairing occurs in nature and that fertilised eggs give rise to a large proportion of females. The eggs are laid on the lower side of the leaf and hatch in 4 or 5 days. The larvae feed on the leaves and moult at least six times, at intervals of 2 or 3 days, hibernating as mature larvae in the case of the last generation of the year. In the laboratory pupation took place both on the surface of and in the soil, the pupal stage lasting from 4 to 7 days. The whole cycle of development occupies about a month and two or three generations probably occur during the summer. No parasites were reared from the larvae in 1913, but four unidentified species were obtained in 1915. To prevent damage to strawberries,

spraying with a 2 or 3 per cent. solution of barium chloride, before the berries ripen, is suggested as a possible remedy.

Roepke (W.). **Eine neue Dryinide aus Java (*Phanerodryinus javanus*, n.g. n. sp.)** [A new Dryinid from Java.]—*Tijdschr. Entom., The Hague,* lix, no. 4, 15th December 1916, pp. 287–292, 3 figs.

An illustrated description is given of a Dryinid, *Phanerodryinus javanus*, gen. et sp. n., from Java. The host is unknown, but is, thought to be one of the larger Flatids, such as *Lawana candida*, occurring in the cacao plantations.

Noel (P.). **Les ennemis du Maïs (*Zea*, L.).** [The Pests of Maize.]—*Bull. Lab. Reg. d'Entom. Agric., Rouen,* January-February-March 1917, pp. 6–10.

The following list of insects attacking maize is given: *Agriotes lineatus*, L. (*segetis*, F.), *Melolontha melolontha*, L. (*vulgaris*, L.), *Pedinus glaber*, F., *Gryllotalpa gryllotalpa*, L. (*vulgaris*, L.), *Locusta* (*Acridium*) *migratoria*, L., *Calliptamus* (*A.*) *italicus*, Hb., *Toxoptera* (*Aphis*) *graminum*, Rond., *Aphis maidis*, Pass., *Pemphigus boyeri*, Pass., *Aphis radicum*, Boy., *Amycla fuscicornis*, Koch, *Blissus leucopterus*, Say, *Trachea* (*Hadena*) *basilinea*, Hb., *Phytometra* (*Plusia*) *gamma*, L., *Heliothis peltigera*, Guen., *H. obsoleta* (*armigera*), in Canada, *Cirphis* (*Leucania*) *zeae*, Dup., *C.* (*L.*) *scirpi*, Dup., *C.* (*L.*) *loreyi*, Dup., *Lycophotia* (*Agrotis*) *praecox*, F., *Pyrausta* (*Botys*) *quadripunctalis*, Schiff., *P.* (*B.*) *nubilalis*, Hb., *Sitotroga cerealla*, Ol. (*Gelechia pyrophagella*, Koll.), in Germany, *Sesamia vuteria* (*nonagriodes*, Steph.), in Algeria, *S. cretica*, Ld. (*cyrnaca*, Mab.), *Eupithecia abbreviata*, Steph. (*cocciferata*, Mab.), *E. unedonata*, Mab., *E. scopariata*, Ramb., *Sylepta* (*Pyralis*) *ruralis*, Villers, and *Tinea zeaella*, Villers.*

Noel (P.). **Les ennemis du Chanvre (*Cannabis*, Journ.).** [The Pests of Hemp.]—*Bull. Lab. Reg. d'Entom. Agric., Rouen,* January-February-March 1917, pp. 11–12.

The following list of insect pests of hemp is given: *Podagrica aerata*, Mrsh., *Phorodon* (*Aphis*) *cannabis*, Pass., *Acherontia* (*Sphinx*) *atropos*, L., *Phytometra* (*Plusia*) *gamma*, L., *Heliothis obsoleta*, Hb. (*armigera*, Hb.), *Polia* (*Mamestra*) *persicariae*, Hb., *Pyrausta nubilalis* (*Botys silacealis*, Hb.), and *Psyche cannabiella*, Doum.†

Silvestri (F.). **Prima notizia sulla presenza della mosca delle olive e di un parassita di essa in India.** [First Note on the Presence of the Olive Fly and a Parasite of it in India.]—Separate from *Rend. R. Acad. dei Lincei, Rome,* xxv, serie 5ª, 2° sem., pt. 11, 3rd December 1916, pp. 424–427, 1 fig.

This paper describes *Dacus oleae* var. *asiatica* nov. collected by Mr. T. B. Fletcher from *Olea* (?) *cuspidata* at Cherat, and its parasite, *Opius ponerophagus*, sp. n., which is allied to *O. concolor*, Szèpl., and *O. dacicida*, Silv.

[* Mr. J. H. Durrant informs us that the synonomy of this moth is as follows:—*Borkhausenia minutella*, L. (1758), = *Tinea mays*, Geoffr. (1762), = *T. zeaella*, Vill. (1789). It is very doubtful whether it is of any economic importance.—Ed.]

[† The identity of this insect is very doubtful. It is possibly a Hymenopteron.—Ed.]

CHIARI (M.). **Lotta invernale contro la "tignola", la "tignoletta" e la "piralide" della vite.** [Winter Control of *Clysia ambiguella*, Hb., *Polychrosis botrana*, Schiff., and *Sparganothis pilleriana*, Schiff.]—*Riv. Agric., Parma,* xxiii, no. 1, 5th January 1917, p. 8.

The usual methods of winter control against vine moths are enumerated in this article, which is intended for popular use.

SCHNEIDER-ORELLI (O.). **Ueber den ungleichen Borkenkäfer an Obstbäumen im Sommer 1916.** [The Bark-beetle, *Anisandrus dispar*, on Fruit Trees in the Summer of 1916.]—*Schweiz. Zeitschr. f. Obst- u. Weinbau, Frauenfeld,* xxvi, nos. 1–2, 8th-20th January 1917, pp. 5–9, & 17–21, 2 figs.

A bark-beetle outbreak was noticed in many Swiss orchards about eight to ten years ago and since 1915 another has developed. While the injury done by *Scolytus* (*Eccoptogaster*) *rugulosus* and *S. pruni* is mostly of a slowly progressive nature, that done by *Xyleborus* (*Anisandrus*) *dispar* is more rapid in its effects, young fruit trees sometimes withering within two to three months after the first attack, unless the borers are driven away by an abundant exudation of sap. During 1916 numbers of eight- to twelve-year-old apple and plum trees on the shores of the Lake of Zurich were attacked by *X. dispar*. Any mechanical injury which interferes with the circulation of sap, even though only temporarily, provides the most favourable conditions for attack by this beetle. It has been erroneously assumed that very vigorous trees are chiefly attacked, but examination of the few bores in such trees shows that the work has been stopped by the flow of sap and that in cases where oviposition has been effected the eggs rot. Incomplete bores are not always covered by new growth, and the impossibility of distinguishing between incomplete, uninhabited bores and those which are densely populated, explains the many inaccurate statements regarding predisposition to attack. The four species of fruit-tree bark-beetles occurring in Switzerland have only one annual generation there, and though *X. dispar* has been stated to have two, this is erroneous and may be due to *S. rugulosus* or *S. pruni* being mistaken for it; these species hibernate as larvae and emerge from six to eight weeks after *X. dispar*. The only practical means of saving a newly attacked tree is to push a plug of wadding steeped in carbon bisulphide deep into the bore-hole, which is then sealed with putty or clay. Only from 2 to 3½ oz. of carbon bisulphide are required per tree. Chloroform, benzine and naphthaline are unsuitable for this purpose.

MASINO (F.). **La colla nella preparazione della poltiglia bordolese.** [Glue in the Preparation of Bordeaux Mixture.]—*Minerva Agraria, Milan,* viii, no. 23–24, 15th–30th December 1916, pp. 284–286. (Abstract from *Atti R. Accad. Agric. Torino*).

The addition of glue to Bordeaux mixture increases the adhesiveness of the spray and modifies its chemical composition. Glue is almost insoluble in cold water, but when it is added to Bordeaux mixture, the copper, instead of remaining as a precipitate of hydrated oxide, is dissolved and combined with the glue, which probably acts as a

weak organic acid, since the Bordeaux mixture turns a deep blue-violet colour. To prepare this spray 10 lb. of copper sulphate crystals are dissolved in 10 gals. of water and in another container 10 lb. of medal glue is soaked in 3–4 gals. of water for 2 or 3 days. At the end of this period 4 gals. of water are brought to the boil in a third container, which is removed from the fire and into which the pieces of softened glue are placed and dissolved. The glue solution is then poured into a vessel marked at the capacity of 40 gals. in which the copper sulphate solution has already been placed. The milk of lime, containing 10 lb. of white quicklime in about 6 gals. of water, is then added, the mixture being well stirred and its bulk brought up to 40 gals. This forms a concentrated stock solution to be diluted with 4 parts of water for use.

Berlese (A.). **Centuria terza di Acari nuovi.** [Third List of One Hundred new Acari.]—Separate, dated 31st December 1916, from *Redia, Florence*, xii, no. 2, pp. 289–338.

This paper describes one hundred new Acarids from various parts of the world.

Paillot (A.). **Microbes nouveaux, Parasites du Hanneton. Action pathogène sur Chenilles de** ***Vanessa urticae, Lymantria dispar*** **et sur Vers à Soie.** [New Microbe Parasites of the Cockchafer. Their pathogenic Action on the Larvae of *Vanessa urticae, Lymantria dispar* and on Silkworms.]—*C. R. Soc. Biol., Paris*, lxxx, no. 2, 20th January 1917, pp. 56–58.

Cockchafers are very frequently infected with Coccobacilli and it often happens that a double infection is present. Three different combinations have been noted and recorded.

Coccobacillus combined with *Diplococcus melolonthae* kills cockchafers in 24 hours, the proportion of the two elements remaining the same even after several passages. *Diplococcus* alone is only slightly pathogenic and kills cockchafers after two or three days, its virulence not being sensibly increased by passage. The larvae of *Lymantria dispar* and silkworms resist this infection to a considerable extent, as *Diplococcus* inoculated into these insects is very rapidly attacked by phagocytes and is unable to multiply.

In the combination of *Coccobacillus* with *Diplobacillus melolonthae*, the second element is fairly abundant; this combination is more pathogenic as regards cockchafers than *Diplococcus*, but is less frequently met with in nature. Experiments on 8 cockchafers resulted in 1 dying 24 hours after inoculation and the rest becoming ill and showing numerous *Diplobacillus* in the blood. Experiments on larvae of *Lymantria dispar* resulted in 2 out of 3 dying 48 hours after inoculation. At the second passage 2 out of 5 died at the end of 3 days, at the third passage 1 died at the end of 48 hours and 1 at the end of 3 days, and at the fourth passage 2 died after 3 days. Silkworms show no greater sensibility to infection by inoculation than do the larvae of *Lymantria*.

The third combination comprises *Coccobacillus* and *Bacillus hoplosternus*, which is very fatal to cockchafers. At the first passage it kills in 24–36 hours and at the second in less than 24 hours. Spores

appear in the dead bodies 2 or 3 days after inoculation. The larvae of *Vanessa urticae* are also very susceptible to this infection. They die in 20 to 24 hours after the first passage, in 8 to 9 hours after the second, and in 6 to 7 after the tenth. Virus of this strength will also kill the larvae if given through the mouth. At the time of death the microbe is relatively scarce in the blood and it therefore appears to cause death by means of the toxin that it secretes. After the death of the insect, the microbe continues to increase rapidly up to the formation of spores. Larvae of *Lymantria dispar* inoculated with *B. hoplosternus* behave in a similar manner as when inoculated with *Diplobacillus*. In one case inoculated larvae were all ill in 24 hours after inoculation; their blood was rich in the parasite, but they did not all die; two were still alive several days later and examination of their blood showed that the *Bacillus* had not multiplied, nor formed spores, but had assumed a modified form. Silkworms are fairly resistant to the action of *B. hoplosternus*, only a small number of those inoculated dying at the end of 48 hours.

Froggatt (W. W.). **A Descriptive Catalogue of the Scale Insects ("Coccidae") of Australia.**—*Agric. Gaz. N.S.W., Sydney*, xxvii, no. 12, December 1916, pp. 883–888, 1 fig. [Received 5th February 1917.]

The species recorded include:—*Pseudococcus* (*Dactylopius*) *candidus*, sp. n., on *Acacia decurrens*; *P.* (*D.*) *ericicola*, Msk., on *Erica autumnalis*; *P.* (*D.*) *grevilleae*, Full., on *Grevillea bipinnatifida*; *P.* (*D.*) *herbicola*, Msk., on *Aristida vagans*; *P.* (*D.*) *hibbertiae*, Msk., on *Hibbertia linearis* and *H. virgata*; *P.* (*D.*) *hilli*, sp. n., on *Acacia* sp.; *P.* (*D.*) *lanigerus*, Full., on *Acacia pulchella*; *P.* (*D.*) *lobulatus*, Msk., on *Eucalyptus*; *P.* (*D.*) *longispinus*, Targ., on *Acacia longifolia* and thistle; *P.* (*D.*) *macrozamiae*, Full., on *Macrozamia frazieri*; *P.* (*D.*) *similans*, Lidg., on daphne; and *P.* (*D.*) *zamiae*, Luc., on *Zamia spiralis*.

Girault (A. A.). **Descriptions of miscellaneous Chalcid-flies.**—*Insecutor Inscitiae Menstruus, Washington, D.C.*, iv, no. 10–12, October-December 1916, pp. 109–121. [Received 3rd February 1917.]

The Chalcidoidea described include:—*Tetrastichus malacosomae*, sp. n., from the eggs of *Malacosoma americana* and *M. disstria* in California and from the eggs of *M. fragilis* in New Mexico; *Eurytoma ctenodactylomyii*, sp. n., and *Neocatolaccus livii*, sp. n., from the galls of *Ctenodactylomyia watsoni* on *Coccolobis uvifera* (sea grape); *Coelopisthia rotundiventris*, sp. n., from New Jersey, associated with *Plagiodera versicolora* on willow; *Elasmus mordax*, sp. n., from *Phyllorycter* (*Lithocolletis*) *guttifinitella* from the District of Columbia; *E. aspidiscae*, sp. n., reared from a cocoon of *Coptodisca* (*Aspidisca*) *splendoriferella* on *Crataegus* from the District of Columbia; and *Isodromus abnormicornis*, sp. n., reared from *Icerya braziliensis* in Brazil.

Crawford (J. C.). **Some new American Hymenoptera.**—*Insecutor Inscitiae Menstruus, Washington, D.C.*, iv, no. 10–12, October-December 1916, pp. 135–144. [Received 3rd February 1917.]

The Hymenopterous parasites here described include:—*Microdontomerus fumipennis*, sp. n., reared from *Malacosoma fragilis*; *Ptinobius texanus*, sp. n., reared from *Otidocephalus carinicollis, Trichobaris texana*, and *Araecerus fasciculatus* in Texas; and *Perilampus chrysopae* var. *laevicephalus*, nov., reared from *Chrysopa californica* at the California State Insectary.

Girault (A. A.). **Descriptiones Hymenopterorum Chalcidoidicorum cum Observationibus.**—*The Entomologist, London*, l, no. 645, February 1917, pp. 36–38.

The following species are recorded: *Cosmocomoidea morilli*, How., reared from leaf-hopper eggs on sugar-cane in Mexico; *Blastothrix bohemani*, Westw.; *Anagrus subalbicornis*, Gir., reared from *Pseudococcus bakeri* on grapes in California; *Euplectrus platypenae*, How., reared from the larva of *Cirphis humidicola* in the British West Indies; *Podagrion mantidiphagum*, sp. n., reared from the egg-mass of a Mantid in the British West Indies; and *Paraleptomastix notatus*, sp. n., reared from *Pseudococcus bakeri* on grapes in California.

Butler (E. A.). **A Contribution to the Life-history of** *Piezodorus lituratus*, **L.**—*Entom. Mthly. Mag., London*, 3rd Ser., iii, no. 26, [liii, no. 633], February 1917, pp. 34–39, 2 figs.

An account is given of the Pentatomid, *Piezodorus lituratus*, L., which is widely distributed on furze (*Ulex europaeus*). The eggs are laid on the young, unopened, but fully formed flower-buds. The larvae have been bred to the second instar in captivity, but refused after that stage to feed on the furze provided, and it is suggested that after this stage they become predaceous. This insect has also been found on other leguminous plants such as *Genista, Melilotus* and *Trifolium*, as well as tamarisk, willow, heather, *Lonicera, Crataegus, Betula, Quercus* and in winter on pines. The eggs are attacked by a Proctotrupid parasite of the genus *Telenomus*.

Marshall (G. A. K.). **On new Species of Indian Curculionidae. Part III.**—*Ann. & Mag. Nat. Hist., London*, xix, no. 110, February 1917, pp. 180–198.

The new weevils described include:—*Onychocnemis careyae*, gen. et sp. n., and *Teluropus ballardi*, gen. et sp. n., on leaves of jak-fruit (*Careya arborea*); *Phaenomerus angulicollis*, sp. n., found in burrows in sundri trees (*Heritiera littoralis*); and *P. brevirostris*, sp. n., found in burrows of Scolytidae and believed to be predaceous on these beetles.

Caesar (L.). **The Plum Curculio in Ontario, Nature and Extent of the Injuries, Conditions favouring the Insect and Means of Control.**—*Canadian Entomologist, London, Ont.*, xlviii, no. 12, December 1916, pp. 397–400 & xlix, no. 1, January 1917, pp. 17–19.

This is a popular account of *Conotrachelus nenuphar* and its control [see this *Review*, Ser. A, iv, p. 262]. Stress is laid on the necessity

for clean surroundings in the orchard, good cultivation and spraying, all of which methods should be combined for the control of this pest in Ontario.

Baker (A. C.). **Synopsis of the Genus** *Saltusaphis* **(Aphididae-Hom.).** *Canadian Entomologist, London, Ont.*, xlix, no. 1, January 1917, pp. 1–9, 3 plates.

A key is given to the various species of the genus *Saltusaphis*, mostly infesting grasses and sedges, and the following species are described: *S. americanus*, sp. n., *S. ballii*, Gill., *S. elongatus*, sp. n., *S. flabellus*, Sanb., *S. scirpus*, Theo., *S. virginicus*, sp. n.

Lyne (W. H.). **Carefully inspect all Imported Fruit and Nursery Stock.**—*Agric. Jl., Victoria, B.C.*, i, no. 11, January 1917, pp. 192–194.

This is an account of the precautions taken against the introduction of diseased or insect-infested nursery stock into British Columbia. The open season during which nursery stock is allowed to enter is from 1st October to 1st May. The methods of inspection and fumigation of plants and the fumigation of stored products are described.

Cameron (A. E.), Treherne (R. C.) & White (E. W.). **The Cost of Spraying in the Control of the Pear Thrips in British Columbia.**—*Agric. Gaz. Canada, Ottawa*, iv, no. 1, January 1917, pp. 13–16.

Useful tables are given showing the actual cost of practical spraying operations by power machines and the actual number of gallons applied to fruit trees of known variety, size and age, with a comparison of the cost per gallon of whale-oil soap and miscible-oil mixtures as used against *Taeniothrips inconsequens*, Uzel.

Brittain (W. H.). **The Apple Maggot in Nova Scotia.**—*Canadian Horticulturist, Toronto*, xl, no. 1, January 1917, pp. 3–4.

This popular account of *Rhagoletis pomonella* contains no information which has not previously been abstracted.

Tiger Beetle Borer of Coffee.—*Planters' Chronicle, Bangalore*, xii, no. 2, 13th January 1917, pp. 14–16.

With reference to Dr. Coleman's statement concerning a Cicindelid boring in coffee [see this *Review*, Ser. A, v, p. 121], the Imperial Entomologist writes that the identity of this borer in India is still uncertain. Some account of *Neocollyris emarginatus*, a Javanese species, is given in this connection. The occurrence of this larva in tea and coffee may prove to be of economic importance, though whether the benefits derived from the predaceous habits of the larvae are more than counterbalanced by the injuries inflicted in boring, is doubtful. A similar larva has been found at Pusa boring in twigs of *Zizyphus jujuba*; the adult beetle has not yet been reared, but it is probably *Neocollyris bonelli ortygia*.

COCKAYNE (A. H.). **The Meadow-Foxtail Midge.**—*Jl. Agric., Wellington, N.Z.*, xiii, no. 6, 20th December 1916, pp. 459–466, 5 figs.

Oligotropus alopecuri is becoming a serious pest of foxtail grass, which during the last decade has been increasingly grown in New Zealand. In Europe this insect is held in check by natural enemies, but in the Manawatu district no parasitised material has been found, and the extraordinary development of the insect in the past three years indicates that practical measures will be necessary for its control. The eggs are laid in clusters, generally on the outer surface of the flowering-glumes and near their base. The larvae on hatching out crawl to the top of the glumes, which they descend on the inside, feeding on the young stamens and sucking the juices from the soft kernel. The larvae pupate where normally the kernel is developed and the first flies emerge about the beginning of September. In New Zealand there are several broods, which probably overlap. Various tentative control measures, such as October mowing, and stocking with cattle, have been tried without much success. Control by natural enemies offers the most hopeful field for investigation, and is being studied. The damage caused by *O. alopecuri* is confined entirely to crops intended for seed, the presence of the insect being of no importance for grazing or haymaking purposes.

WATERSTON (J.). **Notes on Coccid-infesting Chalcidoidea—II.**—*Bull. Entom. Research, London*, vii, no. 3, January 1917, pp. 231–257, 9 figs.

The following new species from the Gold Coast and Southern Nigeria are described: *Aneristus croconotus* from *Lecanium* sp. on orange; *Coccidoxenus coclops* from *Ceroplastes vuilleti*, March.; *Coccidoxenus obscuratus* from *Lecanium somereni*, Newst.; *Chiloneurus afer* from *Pulvinaria jacksoni*, Newst.; *Chiloneurus cyanonotus* from *Lecanium* sp. on *Tephrosia vogilii*, *Cerapterocerus* (*Eusemion*) *pattersoni* from *Vinsonia personata*, Newst.; and *Eunotus truncatipennis* from *Lecanium* ? *somereni*, Newst., on kola.

Some notes on the methods adopted for the preparation of Chalcids for descriptive purposes are also given in this article.

MAULIK (S.). **Solubility of the Scale of *Lepidosaphes ulmi*, Linn.**—*Bull. Entom. Research, London*, vii, no. 3, January 1917, pp. 267–269.

The control of *Lepidosaphes ulmi* by means of insecticides depends to a large extent upon obtaining access to the insect by dissolving the scale with which it covers itself soon after it settles down on the bark; unless this can be dissolved, at least at its point of contact with the bark, no great result can be expected. The effects of a number of reagents were tested, the scales being kept in them for nearly a year. It was found that the scale is not dissolved by concentrated sulphuric acid or by sodium carbonate, even if heated; it is hygroscopic, losing 8 to 9 per cent. in weight when heated in a water bath; it contains about 4·5 per cent. of nitrogen and it dissolves in a normal solution of caustic soda or potash. Although soluble in caustic soda in a test-tube, it resists the action of this fluid to a great extent when used as a spray. When tested on scale-insects in test-tubes, it was found that of the three washes in general use against

this pest, i.e., the caustic alkali wash, paraffin emulsion and the Woburn wash, only the first had any solvent action. All these washes have however been found useful to a certain extent, probably on account of the physical property of the paraffin oil contained in them. Owing to the position of the spiracles being on the ventral side of the insect they are more or less protected by its body, and this fact lessens the chances of the spraying fluid reaching them.

The following method of dealing with this pest is advised: the trunks of the trees and the larger branches should be scrubbed with a hard brush and hot water in winter, and in the spring those trees on which newly hatched insects are present should be sprayed with a weak kerosene emulsion. Several spraying operations will be necessary.

WILLIAMS (C. B.). **Notes on a Froghopper attacking Sugar-cane at Marienburg Estate, Surinam.**—*Bull. Entom. Research, London,* vii, no. 3, January 1917, pp. 271–272.

Examples of the froghopper, *Tomaspis tristis*, F., were found commonly on two parts of the estate which were most heavily infested the year before (1915). The adult is much larger than the Trinidad species (*T. saccharina*, Dist.). It is found in the characteristic position, head upwards, at the base of the leaves of the cane. Eggs laid by females in captivity, which were given the choice of green leaves or moist dead trash, were found without exception in the trash. They were embedded in the material more deeply than is usual in *T. saccharina.* The young, surrounded by their froth, were found usually under the leaf-sheaths of the cane from near the ground to three to four feet, and in one case nearly five feet, from the ground. No nymphs are reported as occurring on the roots. This is an important difference in habit from both the Trinidad froghopper (*T. saccharina*) and the Demerara species (*T. flavilatera*, Urich). The texture of the froth resembles that of *T. saccharina* and is not like the close, stiff froth of *T. pubescens*, F., one specimen of which was obtained on grass alongside the cane-fields. A description of the nymph in its various stages is given. No natural enemies were observed. The control measure likely to yield the best results is hand-picking. Spraying, if considered practicable, should be thorough, while the efficacy of light traps might be tested. The introduction of the green muscardine fungus (*Metarrhizium anisopliae*) might be a successful measure of control in view of the short, and comparatively moist, dry seasons in Surinam.

The nearest related species in Trinidad is *T. guppyi*, Urich, an apparently rare species of which the habits are unknown.

BURKE (H. E.). **Flat-headed Borers affecting Forest Trees in the United States.**—*U.S. Dept. Agric., Washington, D.C.,* Bull. no. 437, 16th January 1917, 8 pp., 9 plates.

Buprestid larvae, known as flat-headed borers, attack both deciduous and coniferous trees, as well as shrubs and herbaceous plants; they chiefly damage the bark and wood of the main trunk, though all other parts of the plant are liable to attack. Eggs are deposited singly or in a mass on the surface or in crevices in the bark, the larva

mining its way inwards and forming an oval cell in which it pupates. The egg is usually laid in spring or summer, and the larva feeds and rests until the autumn either of the same year or of the second or third year before reaching maturity. It hibernates either in the larval stage or in the adult stage in the pupal cell, the adult emerging in the spring or summer. The beetle, after mating and oviposition, dies before the end of summer.

Certain species cause the formation of galls on the host-plant, while others produce galls on some plants and not on others. The common species of *Agrilus* infesting the alder causes galls in Oregon, while it seldom does so in California. Although the usual food of the adults is the foliage of the host-plant, some are pollen feeders and some feed on the spores of fungi. *Agrilus bilineatus* is of some benefit in destroying chestnut blight fungus; *Melanophila consputa*, Lec., has been observed devouring scorched termites on an old spruce log. A key is given to the genera of Buprestid larvae, with particulars of their distribution, habits and food-plants.

A bibliography of nine works is appended.

Quaintance (A. L.) & Baker (A. C.). **A Contribution to our Knowledge of the Whiteflies of the Subfamily Aleyrodinae (Aleyrodidae).**—Separate, dated 20th January 1917, from *Proc. U. S. Nat. Mus., Washington, D.C.*, Vol. 51, pp. 335–445, 46 plates.

This systematic paper is a continuation of the authors' previous work on the Aleurodidae. Keys are given to the various species of the different genera, eight new sub-genera being erected and 36 new species described.

McGregor (E. A.). **Descriptions of Seven New Species of Red Spiders.** Separate, dated 15th January 1917, from *Proc. U.S. Nat. Mus., Washington, D.C.*, Vol. 51, pp. 581–590, 7 plates.

The species here described, which are of some economic importance, are:—*Tetranychus peruvianus* on willow (*Salix*) in Peru; the presence of this mite causes the leaves to turn yellow and drop, but does not appear greatly to injure the trees; *T. rusti* attacking the foliage of papaw (*Carica papaya*) in Peru; *T. monticolus* found at an altitude of 6,000 feet, on the leaves of large-berried huckleberry (*Vaccinium* sp.) in Oregon; this species causes considerable discoloration and dropping of the leaves; *T. oregonensis* on wild cherry (*Prunus* sp.) in Oregon; *T. willamettei* on the leaves of the white oak (*Quercus lobata*), to which it imparts a rusty appearance in Oregon; *T. ilicis* on American holly (*Ilex opaca*) in S. Carolina; and *T. macdonoughi* injuring the leaves of *Oxalis stricta* in Florida.

Böving (A.). **A Generic Synopsis of the Coccinellid Larvae in the United States National Museum, with a Description of the Larva of** *Hyperaspis binotata*, **Say.**—Separate, dated 15th January 1917, from *Proc. U.S. Nat. Mus., Washington, D.C.*, vol. 51, pp. 621–650, 4 plates.

This paper, the contents of which are indicated by the title, supplements a former one by F. L. Simanton on *H. binotata* [see this *Review*, Ser. A, iv, p. 282].

Harland (S. C.). **Report of the Assistant Superintendent of Agriculture on the Entomological and Mycological Work carried out during the Season under Review.**—*Rept. Dept. Agric., St. Vincent, 1915–1916, Barbados*, 1916, pp. 7–34. [Received 20th February 1917.]

Some of the investigations dealt with in this report have already been recorded [see this *Review*, Ser. A, iv, pp. 42, 321, 416].

Insect pests noted during the year included:—

On cotton, *Alabama argillacea* (cotton worm) and *Eriophyes gossypii*, Bks. (leaf-blister mite). Investigations were carried out to determine the resistance of budded cottons and cotton hybrids to the latter pest and the results are embodied in a separate paper [see this *Review*, Ser. A, v, p. 109]. *Saissetia nigra* (black scale) and *Colaspis fastidiosa* (bronze beetle) were minor pests. *Corythuca* sp. feeds on the leaves. Two new pests have been observed at the Experiment Station; cotton plants blown to the ground by high winds were tunnelled by a beetle larva, the adult of which has not been reared. A species of thrips has been found attacking the bolls and leaves; nothing is known of its life-history and no natural enemies have been discovered.

Pests of cassava included:—*Cryptorrhynchus* sp. (cassava borer), of which no natural enemies are known; this pest will be an important one if the cultivation of cassava is extended. *Dactylopius* sp. (mealy-bug) is parasitised by the larva of an unidentified Syrphid fly and of a Lepidopteron, neither of which is sufficient for its control. For both this pest and *Cryptorrhynchus* a close season for cassava is recommended. *Diaprepes spengleri*, L., in some cases almost defoliated the plants; no control measures have been attempted. Eggs of *Erinnyis ello*, L. (cassava hawk-moth) were abundant, but are parasitised by a small Hymenopteron. Two cassava thrips, *Corynothrips stenoptera* and *Frankliniella melanommatus*, again caused considerable damage; the growth of young cassava near old infested fields encourages this pest. *Cecidomyia manihot*, Felt (cassava gall maggot) does very little damage and is extensively parasitised by minute Hymenoptera. A small mite was found to cause premature leaf-shedding at the Experiment Station.

Maize pests included the mole-cricket (*Scapteriscus didactylus*), which severely damages the young plants, and for which no adequate control has yet been undertaken. A fungus which has been found attacking the insect does not seem to be an important check. *Laphygma frugiperda*, the larva of which is a serious pest, can be controlled by a mixture of lead arsenate and low-grade arrowroot or cassava starch in the ratio of 1 part to 30, which is dropped into the heart of the young plant by means of a pen-nib. This pest is able to complete its life-history on a large number of plants. No larval or pupal parasites have been found. *Diatraea saccharalis*, F. (moth borer of sugar-cane) is the most serious maize pest in St. Vincent. Eggs are continually collected and these are also controlled by the parasites *Prophanurus alecto*, Crawfd., and *Trichogramma minutum*. As this moth prefers to oviposit on maize rather than on sugar-cane, old maize stalks should be cleared from fields to prevent the completion of its life-history. *Heliothis obsoleta*, F. (boll worm) attacks maize, but is largely controlled by egg-parasites. *Agromyza* sp. (leaf-miner) is extensively parasitised by Chalcids.

A Geometrid and a Hesperid are unimportant pests; an Aphid pest is preyed upon by Syrphid flies, the pupae of which are themselves parasitised by a Hymenopteron. A Braconid parasite has also been reared from this Aphid.

The arrowroot worm, *Calpodes ethlius*, Cr., was controlled by parasites, which included three species of Tachinid flies.

A table is given showing the parasites and leaf-miners that have been reared during the year.

A small moth has been found parasitising the predaceous and beneficial wasp, *Polistes annularis.*

Bodkin (G. E.). **Report of the Economic Biologist.**—*Rept. Dept. Sci. & Agric. B. Guiana, for the Nine Months ended 31st December 1915, Georgetown,* 12th July 1916, 10 pp. [Received 27th February 1917.]

No substantial change in the status of insect pests connected with sugar-cane is recorded.

An ant, *Atta* (*Acromyrmex*) *octospina*, Reich., was observed to remove the layer of tissue immediately overlying the cambium of recently tapped rubber trees, causing considerable damage. It forms nests in hollow, decaying logs, which are easily destroyed without the aid of chemicals. It has only been observed in one locality.

Two formidable pests of coconuts were active in different parts of the Colony during this period. *Brassolis sophorae*, L., again made its appearance on the east coast, defoliating large areas of palms, and a nest was found at Potaro, though it appears to be now almost extinct in Georgetown. It is preyed upon by the kiskadee (*Pitangus sulphuratus*). The district was proclaimed under the Plant Diseases and Pests (Prevention) Ordnance, with some good effect, but the pest showed a distinct tendency to spread along the coast. On the Upper Courantyne Coast a large Acridiid, *Tropidacris latreillei*, Perty, made its appearance in great numbers and rapidly defoliated the coconut palms in the district; consequently a large area was there proclaimed under the Ordinance. The Coccid, *Aspidiotus destructor*, Sign., continues to be destructive in some areas. Two additional minor pests are the Lepidoptera, *Perichares corydon*, F., and *Opsiphanes cassiae*, Feld.

Citrus plants were attacked by the larva of an undetermined species of *Papilio* and by *Heliothrips haemorrhoidalis*, Bch. No serious pests were observed. The weevil, *Heilipus ocellatus*, F., was observed attacking the bark of young pines. The larva of a fruit fly has been found in the fruit of imported orange trees. The guava fruit fly, *Anastrepha striata*, Schin., is the only fruit fly of importance at present known to occur in the Colony.

The attacks on rice by the two leaf-eating caterpillars, *Laphygma frugiperda*, S. & A., and *Pelamia* (*Remigia*) *repanda*, F., have only been slight, but the ant, *Solenopsis pylades*, Forel, has been observed to hollow out the stems of fully grown rice plants. In one instance it was noticed to attack and destroy a larva of *Diatraea* which was occupying the stem.

The pests of vegetables, garden-plants and fruit have been given some attention. Cucumbers and pumpkins were attacked by

the larvae of the Pyralids, *Diaphania hyalinata*, L., and *D.* (*Glyphodes*) *nitidalis*, Cram. A lead arsenate spray will satisfactorily control the former. Sweet potatoes were infested by the bug, *Spartocera batatas*, F., the larva of the Pyralid, *Terastia pusialis*, Snell., a Eumolpid beetle, *Typophorus nigritus*, and the sweet potato weevil, *Euscepes* (*Cryptorrhynchus*) *batatae*, Waterh. Considerable damage was done to tannias and eddoes by the larva of a hard-back (probably *Oxyligyrus zoilus*, Oliv.). *Diatraea saccharalis*, F., is fairly common in some districts on maize, and in others the larva of *Laphygma frugiperda*, S. & A., completely destroys young plants by eating out the central shoot. It may be effectively controlled by introducing a small quantity of lead arsenate into the heart of the plant. Egg-plants were attacked by *Epitrix pilosa*, Jac., which may be controlled by dusting with lead arsenate; the Coccids, *Saissetia hemisphaerica*, Targ., and *Pseudococcus virgatus*, Ckll.; and an Aleurodid, *Aleurodicus* sp. On peppers the larvae of *L. frugiperda* and of *Protoparce sexta paphus*, Cram., have been observed. Cassava was attacked by a Pyralid borer and the larva of *Erinnyis ello*, L.

No serious pest of bananas and plantains was noted, but the larvae of *Castnia licus*, Westw., the Syntomid moth, *Antichloria eriphia*, F., and *Caligo illioneus illioneus*, Cram., were occasionally found.

Guava fruits were frequently infested by the guava fruit fly, *Anastrepha striata*, Schin., and at times by the guava fire-tail moth, *Pyrrhopyge amyclas*, Cram., as well as the Coccid, *Pulvinaria pyriformis*, Ckll., which was very troublesome at times.

Mango trees are often severely infested by the Coccid, *Coccus* (*Lecanium*) *mangiferae*, Green. It covers the leaves with a sticky secretion and they are then attacked by a sooty fungus. The mango hairy worm is also prevalent, as well as the Coccid, *Aulacaspis rosae*, Bch.

The pests of soursop (*Anona muricata*) include the larva of the moth, *Claphe lasconia*, Druce, a species of Aphid, the larva of the Limacodid, *Sibine fusca*, Stoll, and a large Aleurodid, *Aleurodicus giganteus*, Q. & B.

The Coccid, *Orthezia insignis*, Dougl., is sometimes most destructive to roses and bougainvillea. A thorough pruning followed by several applications of kerosene emulsion is recommended as the most effective control measure.

Stored products such as rice, corn, cashew nuts, biscuits, etc., are liable to become infested with the grain weevil (*Calandra oryzae*, L.), the larva of the Angoumois grain moth (*Sitotroga cereallella*, Oliv.) and the confused flour beetle (*Tribolium confusum*, Duv.). These may be controlled by fumigation with carbon bisulphide. Considerable loss in cigars and cigarettes is caused by the cigar beetle, *Lasioderma serricorne*, F. Fumigation will effectively control this pest, which also causes considerable damage to books on open shelves. These should be kept in well constructed cases, regularly fumigated, and a quantity of napthaline kept on the shelves.

Tables, cupboards, etc., should be rendered ant-proof by standing them in large bowls filled with kerosene and water. The ants that commonly occur are the red household ant (*Solenopsis corticalis*, For., subsp. *amazonicus*, For.), the small crazy ant (*Tapinoma melanocephalum*, F.) and the black crazy ant (*Prenolepis longicornis*, Mayr).

(J. C. H.). **The Spiny Citrus Whitefly. A potential Pest of Citrus Trees.**—*Agric. News, Barbados,* xvi, no. 384, 13th January 1917, pp. 10–11.

Much of the information contained in this paper is taken from a previous article [see this *Review,* Ser. A, iv, p. 387]. A spray, which has been found efficacious against *Aleurocanthus woglumi,* Ashby, consists of whale-oil soap, 2 lb., heavy paraffin oil, 2 gals., water, 1 gal., forming a concentrated emulsion. Three sprayings are necessary for adequate control. The great rapidity of dispersion of this Aleurodid under favourable conditions makes it a potential pest which is capable of doing considerable damage in a short time.

Urich (F. W.). **Insect Pests in Trinidad.**—*Entomologist's Report, Minutes Meeting Bd. Agric., Trinidad,* 1916, pp. 1–56. [Received 27th January 1917.]

Much of the matter in this report has already been abstracted from other papers by the same author.

Cosmopolites sordidus (black banana weevil) is reported from some localities in Trinidad. The plants are attacked at the base; full-grown plants do not as a rule suffer much, but young suckers attacked by the weevils die. The full-grown trees when badly infested fall over and all the leaves wither. Growers are recommended to dig up and burn all infested stools, to plough and fork the land and give it a thorough liming. Experiments will be undertaken to determine whether a Histerid beetle which attacks the larvae of *Metamasius* may be useful as a natural check on this pest.

Ancistrosoma tobagoensis was found in the larval stage at Tobago in the soil near young coconut roots. It is not yet known whether it damages coconut roots, but it is certainly injurious to young plants with tender roots.

Thrips are found to reach their maximum development during the last three months of the year. The spraying mixture that has proved most efficacious is Black Leaf 40, in the proportion of 1 gal. to 1,200 gals. water. This solution mixes well with Bordeaux and both are used advantageously for thrips on cacao. Stronger solutions are required for killing the larvae and nymphs than for the adults, the nymphs being the most resistant.

Jones (T. H.). **A List of the Coccidae of Porto Rico.**—Separate, dated January 1917, from *Jl. Bd. Commissioners Agric. of Porto Rico, Porto Rico,* vol. 1, no. 1, pp. 1–16.

This list includes all the species of Coccidae known from the island of Porto Rico, with their host-plants and localities. A bibliography of 25 works is given.

Wadsworth (J. T.). **Report on a Trial of Tarred Felt "Discs" for protecting Cabbages and Cauliflowers from attacks of the Cabbage-root-Fly.**—*Ann. App. Biology, London,* iii, nos. 2 & 3, January 1917, pp. 82–92, 1 plate.

A full account of experiments made with tarred felt discs as used in America and Canada for the control of cabbage maggots

Chortophila brassicae) is given. The results obtained prove conclusivelv that they are a very effective means of protection against the attacks of these insects. They are $2\frac{1}{2}$ inches square with two slits, a long one from the centre of one edge to a point half an inch beyond the centre of the disc and a short one, three-quarters of an inch long, at right angles to the other in the centre of the disc. The land on which the experiments were made had been partly under cauliflowers the previous year and had suffered severely from maggots; this was planted with 816 cabbages and 932 cauliflowers, half the number in each case, i.e., the alternate rows, being protected, the rest being used as controls. Of the 466 protected cauliflowers only 24 were lost, as compared with 294 of the unprotected ones. The results obtained with cabbages were even more marked, only one plant being lost out of 408 protected by the discs. Cabbages however appear to be less liable to infestation than cauliflowers as only 13·2 per cent. of the unprotected cabbages were lost as against 63·0 per cent. of cauliflowers.

The best results are obtained if the soil is in a fine friable condition when the discs are placed in position and if the plants are placed on slight ridges rather than in depressions. The discs should lie evenly on the soil so that the females cannot crawl underneath them and deposit eggs; they should not be below the surface level, since in wet weather they may become covered with soil and therefore less efficient. They should be placed round the plants directly after planting out, if this is done later than the first week of May.

Plants protected by these discs have been observed to be larger and to mature earlier than unprotected ones, owing partly to the absence of maggots and partly to the conservation of moisture round the roots. Root maggot infestation is more likely to occur on light soils than on heavy ones.

A bibliography of 15 references is given.

Ford (G. H.). **Observations on the Larval and Pupal Stages of** *Agriotes obscurus*, **L.**—*Ann. of App. Biol., London*, iii, nos. 2 & 3, January 1917, pp. 97–115, 1 fig., 1 plate.

Agriotes obscurus, the larval and pupal stages of which are described fully in this article, is preyed upon by birds (especially the common plover) and moles, as well as by the Carabid beetles, *Pterostichus madidus* and *Nebria brevicollis*. It is very free from internal parasites, but has been reported as being attacked by a Hymenopteron and by a fungus (*Isaria*), though no definite data are available. The larval period lasts probably four rather than five years; pupation takes place in an earthern cell about a foot below the surface of the soil and the insect hibernates in the adult stage.

A bibliography of 10 references is given.

Petherbridge (F. R.). **Note on the Attacks of** *Phyllotreta vittula* **on Spring Corn.**—*Ann. App. Biology, London*, iii, nos. 2 & 3, January 1917, pp. 138–139.

Phyllotreta vittula was recorded as attacking barley in Wiltshire in April 1914, and in May 1916; a similar attack was noticed at the Rothamstead Experimental Station, where it also damaged oats.

In neither case was the infestation as severe as that recorded by Lind, Rostrup and Ravn [see this *Review*, Ser. A, iii, p. 698] in Denmark. The beetles disappeared by the end of May and a second brood was not observed. The attack occurred in both cases when the plants were very young and at a stage when they are most likely to receive a severe check. In view of the seriousness of the attacks on spring-sown corn in Russia, it is advisable to watch for any extension of this pest.

LEES (A. H.). **The Best Time for Lime-Spraying Fruit Trees.**—*Jl. Bd. Agric., London*, xxiii, no. 11, February 1917, pp. 1091–1095, 2 plates.

It was formerly thought that the period just before the buds begin to swell, or at first sign of swelling, was the best time for lime-spraying, but subsequent experience has tended to suggest that a later period is advisable. Eggs of the apple sucker (*Psylla mali*) begin to hatch early in April, those of the rosy apple aphis (*Aphis kochi*) about mid-April. The best results in the control of these two most important apple pests are therefore obtained by beginning to spray rather before 10th April. If ordinary lime mixture is employed, consisting of 20 lb. lime to 10 gals. water, spraying should be as late as possible before the eggs begin to hatch, since a coat of lime does not remain effective for an unlimited time. As its action is mechanical rather than chemical, its effectiveness depends upon there being a firm coat over the twigs at the time the eggs hatch. Fresh lime in lumps of 98 per cent. purity should be used. In slaking, the mixture should be allowed to get as hot as possible and this should be effected, if possible, at least six hours before use, as this increases the adhesive power. The diluted lime wash should be strained through a one-sixteenth inch metal sieve and the mixture should be applied through a machine and nozzle especially adapted for lime sprays. Experiments to test the possible injury to plants by late spraying have shown that lime-spraying may be carried out for apple trees up to the 27th April, when the flower is nearly out; though apples are occasionally damaged by late spraying, the conditions under which damage occurs are not yet fully understood.

GOSSARD (H. A.) & EASTWOOD (G. R.). **County Co-operation to control Hessian Fly.**—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster*, i, no. 8, August 1916, pp. 230–232. [Received 27th February 1917.]

This paper indicates the results of the efforts made in Miami county to reduce the Hessian fly (*Mayetiola destructor*) [see this *Review*, Ser. A, iv, p. 194]. An inspection in November revealed no larvae or pupae in the fields, though the plots on the County Experiment Farm sown in September were practically destroyed. Large numbers of larvae and pupae were however found in self-sown wheat in uncut fields. An examination on 28th June 1916 showed better results than had been anticipated, scarcely 5 per cent. of infestation occurring in the worst fields.

YINGLING (H. C.). **The White-marked Tussock Moth** (*Hemerocampa leucostigma*, **A. & S.**).—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster*, i, no. 9, September 1916, pp. 265–270, 5 figs. [Received 27th February 1917.]

This insect is widely distributed throughout the States and is the most destructive pest attacking the foliage of shade trees in the larger cities. Since the females are wingless, flight plays no part in the spread of the pest, which is probably brought about by migration of the larvae, by wind or importation on nursery stock. The eggs are conspicuous white masses laid on the cocoons. In Ohio there are two broods, though in some States there is only one generation, and in others, three. The eggs of one brood hibernate and hatch in early May. The larvae moult about five times and, when mature, they crawl down the trunk or main branches and spin cocoons, generally about 10 or 12 feet from the ground. The pupal stage lasts about two weeks, the adults emerging in early July. The eggs of the second brood hatch in about a fortnight. Many shade trees are damaged by the larvae, sometimes resulting in complete defoliation.

H. leucostigma has many natural enemies, being parasitised even to the fourth degree, the primary and tertiary parasites controlling the moth, while the secondaries and quaternaries encourage its increase. A list of 21 primary parasites of the moth has been compiled by Dr. Howard, 15 being Hymenoptera and 6 Diptera. The principal is *Pimpla inquisitor*, which is itself parasitised by *Dibrachys boucheanus*. The author has reared two additional primary parasites, *Ichneumon unifasciatorius*, Say, and *I. seminiger*, Cress., not recorded by Dr. Howard. Two Dermestid beetles have also been found feeding on the larvae of the moth. Native birds are a useful control, but unless the English sparrow is first exterminated, these cannot nest freely.

The spray recommended against the caterpillars is 3 to 5 lb. arsenate of lead to 50 U.S. gals. water. Banding the trees with some such substance as tanglefoot catches the larvae as they crawl down, and saturating the egg-masses with creosote by means of a small sponge on a pole is effective; but as these are so conspicuous, the cheapest and easiest method is to remove them by hand. It is advisable to keep the cocoons until the moths have emerged and then destroy the eggs, allowing any parasites to escape unharmed.

WALTON (W. R.) & LUGINBILL (P.). **The Fall Army Worm or "Grass Worm" and its Control.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 752, November 1916, 16 pp.. 13 figs. [Received 27th February 1917.]

This paper gives a popular account of the life-history and habits of the Noctuid, *Laphygma frugiperda*, S. & A., which is prevalent throughout the south-eastern States. Its natural enemies include:—*Chelonus texanus*, *Winthemia quadripustulata*, *Archytas piliventris*, and the bug, *Podisus maculiventris*. Amongst control measures recommended is a poison spray to be used as soon as the presence of the caterpillars is noticed on the grass. In badly infested fields, when the caterpillars have gone down into the ground to pupate, the surface should be lightly cultivated. When caterpillars are on the march, or are beginning to infest a field at one corner, a deep

furrow should be ploughed just in front of them. A log dragged along the furrow will kill the larvae. Grass and other vegetation of no value should be sprayed with a mixture of Paris green and water, 2lb. to 50 U.S. gals. Growing grasses and forage crops should be sprayed with 1 lb. lead arsenate in powder form, or 2 lb. in paste form, to 50 U.S. gals. water. When maize is infested, the following poison mixtures are recommended: 50 U.S. gals. water and 2 lb. powdered arsenate of lead, or 4 lb. paste; or 1 lb. Paris green and 2 lb. freshly slaked lime; or 1 lb. arsenite of zinc and 1 lb. freshly slaked lime. White arsenic must never be used on plants, as it scorches them. Poison bait scattered over the fields is very efficacious. For this purpose, 50 lb. bran is mixed with 1 lb. Paris green or 2 lb. lead arsenate, and 2 U.S. gals. molasses and 6 chopped lemons are added.

Brooks (F. E.). **Orchard Bark-beetles and Pinhole Borers, and how to control them.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 763, 29th November 1916, 15 pp., 18 figs. [Received 27th February 1917.]

A brief account is here given of the principal bark-beetles attacking fruit trees and their control. *Scolytus rugulosus*, Ratz., is found both in orchards and on wild fruit trees and always attacks weak or unhealthy trees. In the northern States there are two generations annually, while in the South there are probably three or four. The adult beetle enters the trunk by making a round hole and burrows parallel with the grain of the wood, depositing eggs as she goes. The larvae burrow between the bark and sapwood, at right angles to the main burrow. After feeding for 30 to 36 days they pupate in specially constructed cells just beneath the surface of the sapwood. The adults gnaw through the bark, making small round exit holes. In healthy trees, a flow of gum from the wounds made by the adults will often prevent the development of larvae, but as the tree is weakened, the gum ceases to flow and leaves the tree open to the depredations of the beetles. Natural enemies of this species include the Chalcid, *Cheiropachys colon*, L., and other Hymenoptera, as well as woodpeckers.

Phloeotribus liminaris, Harr. (peach-tree bark-beetle) chiefly attacks peach, cherry and sometimes plum trees. There are two generations, which overlap, all stages of the insect being found at one time. The adult burrows across the grain of the wood, depositing eggs in little pockets in the burrow. The larvae bore at right angles to the main burrow and after about 30 days pupate within the bark, whence the adults emerge after a few days. Both these species can be checked by clearing away all damaged or unhealthy branches and so limiting the breeding-places. A thick coat of whitewash should be applied to the trunks three times in the year, in early spring, midsummer and autumn. A pint of crude cresylic acid added to each 10 gallons of whitewash is an improvement and a handful of salt to each pailful renders the mixture more adhesive. The whitewash will not kill the insects already in the trees, but will check oviposition and preserve the health of the tree. This has been found the cheapest, simplest and most effective method of control.

Other Scolytid bark pests, which may be controlled in the same way, include *Pterocyclon* (*Monarthrum*) *mali*, Fitch, attacking apple, plum, cherry and orange. *P.* (*M.*) *fasciatum* is an allied species of similar appearance and habits. The walls of the burrows of the adult are covered with a black fungus on which both it and its larvae feed.

Xyleborus dispar, F. (*Anisandrus pyri*, Peck) (pear-blight beetle) attacks apple, pear, peach and plum trees, causing a dying back of the wood in smaller branches similar to the bacterial disease known as pear blight or twig blight. The adult usually enters a twig at the base of a bud. The life-cycle is completed within the burrow, the adult of the next generation issuing through the entrance hole. Infested twigs should be cut out and burnt and the control methods already described should be employed.

Sanders (G. E.) & Brittain (W. H.). **Spraying for Insects affecting Apple Orchards in Nova Scotia.**—*Dominion of Canada Dept. Agric., Entom. Branch, Ottawa,* Circ. no. 8, 1916, 11 pp. [Received 27th February 1917.]

This circular contains the results of spraying experiments carried on in Nova Scotia during the last two years, together with notes on the control of certain insects affecting apples and pears that are prevalent at the present time. The spraying calendar given in a former circular has been revised in accordance with the result of later work.

Of the insects which require control, the green apple bug (*Lygus communis* var. *novascotiensis*, Knight) needs special methods. This pest can only be destroyed by a contact poison applied directly to its body. In spraying badly infested trees, large numbers drop to the ground and after spraying, re-ascend the trees. The hatching period is spread over a considerable time, commencing several days before the blossoms open and continuing, though at a greatly reduced rate, through the blossoming period. The adults are strong fliers and are attracted to pears from infested apple trees near at hand. To control this pest all infested trees should be thoroughly pruned so that all parts will be readily accessible to the spray. Where infestation is severe, the trees should be banded with tanglefoot, and all grass and weeds eradicated from the orchard. Apple trees should be sprayed with nicotine sulphate just before the blossoms open and again, if necessary, just after they fall. In cases of light infestation careful and correctly timed spraying will be sufficient without banding. The control of this insect on pears must follow after the apple trees have been dealt with. If immature bugs only are present on pear trees, one spray immediately before the blossoms fall is usually sufficient. A very heavy, drenching, driving spray is necessary, applied to each limb individually and from every angle at a pressure of at least 200 pounds.

Experiments conducted during 1915 showed that in many cases a serious reduction in crops resulted from using too strong a lime-sulphur spray. In 1916 further experiments were made to find out at what strength lime-sulphur caused burning and at what period it did the most damage. The results obtained showed that on trees

sprayed with lime and sulphur of the following strengths: 1 gal. concentrated commercial lime and sulphur solution to 75 gals. of water, 1 gal. of the same solution to 60 gals. of water and 1 gal. to 50 gals. of water to each of which ordinary lead arsenate paste was added in the proportion of 5 lb. to 100 gals., no injury involving reduction of the crop was observed. Any sprays above this strength caused a loss amounting to as much as 85 per cent. of the crop, the fall of the fruit occurring after the application of the fourth spray. The period of greatest danger from too strong lime and sulphur is from ten days to two weeks after the blossoms fall. Bordeaux mixture used according to the 4–4–40 formula, two weeks after the blossoms fell, caused no drop of the fruit and only 3 per cent. of the crop sprayed showed slight russeting. The ideal spray was found to be lime and sulphur and arsenate of lime, which is safer than arsenate of lead and may be used in the proportion of 2 lb. to 100 gals. of solution, applied twice, before the blossoms open, and dilute lime and sulphur and slightly less arsenate of lime immediately after the blossoms fall, followed two weeks later by weak Bordeaux mixture. An orchard in which this spray was used showed 99 per cent. of the crop to be free from apple scab.

A table is given for diluting lime-sulphur for each spray. For Bordeaux mixture the proportion recommended is 7 lb. copper sulphate, and 7 lb. lime (stone) to 100 gals. of water.

HOWARD (L. O.). **Report of the Entomologist for the Year ended June 30th 1916.**—*U.S. Dept. Agric., Bureau of Entom., Washington, D.C.*, 24th August 1916, 24 pp. [Received 27th February 1917.]

In connection with the control of the gipsy-moth (*Lymantria dispar*) in New England, 214 towns in all have been examined during the year, as well as over 12,000 miles of roadways and 24,000 acres of woodland. As a result, this pest has been reported for the first time in 10 towns in New Hampshire, 2 in Vermont, 2 in Massachusetts and 1 in Connecticut, and apparently has been exterminated in 2 towns in New Hampshire, 2 in Vermont, 4 in Massachusetts and 3 in Connecticut. This shows a lower net increase than in previous years. There has been a noticeable decrease in the number of insects in the towns along the border which were treated last year, and satisfactory results have accrued from the work done in towns inside the border in order to prevent continued spread throughout adjoining areas. The colonies formerly existing in Great Barrington and Lenox have apparently been exterminated. It is believed that the insect has been exterminated in Ohio and New Jersey. In New York State eight egg-clusters were found outside the area sprayed last year. The severity of infestation by the brown-tail moth (*Euproctis chrysorrhoea*) has steadily decreased and it is not spreading into new territory. Out of 37,444 shipments of quarantined products examined during the year, 644 were found to be infested, 11,159 specimens of gipsy moth in all stages except the adult form and 517 brown-tail moth webs being destroyed. Under new regulations, shipments that are being sent into slightly infested territory must now be inspected in the same way as those which pass outside the quarantined area. A large number of experiments have been conducted with

several kinds of tree-banding material with the object of reducing the cost of this method of control. The study of the gipsy-moth as a cranberry pest has been continued, special attention being given to the dispersal of small caterpillars over the bogs on account of the wind drift, the increase of the gipsy-moth under normal field conditions, the relation of disease and parasites, and the effect of defoliation on different species of trees. The investigation of the so-called wilt disease of *Lymantria dispar* has revealed many facts concerning the obscure causative organism of this disease, which is an important factor in the reduction of the number of the pest and also attacks many native caterpillars. Many colonies of the Japanese egg-parasite, *Schedius kuvanae*, were liberated in Massachusetts and New Hampshire, and *Anastatus bifasciatus* was colonised in Maine, New Hampshire and Massachusetts. Satisfactory results have been obtained from the parasites, *Apanteles lacteicolor*, *Meteorus versicolor*, and *A. melanoscelis*, and the Tachinid flies, *Compsilura concinnata* and *Zygobothria nidicola*. *Calosoma sycophanta* continues to exercise effective control, though less numerous than in the previous year.

In connection with the control of insects affecting deciduous fruits, an effective band trap against the codling moth on apples has been devised, which allows the larvae to enter to pupate, but prevents the exit of the moths [see this *Review*, Ser. A, v, p. 113]. Orchard spraying and dusting experiments on a large scale are being carried out, and investigations of apple-tree borers have been continued and extended. It has been found that the common service tree is very largely responsible for the distribution of the round-headed apple-tree borer (*Saperda candida*). The results of investigations indicate that the stigmonose injury to apples is connected with the puncture of the fruit by Aphids and especially the rosy aphis. Experiments in the use of poisonous gases against the woolly apple aphis (*Eriosoma lanigerum*) and the peach-tree borer (*Aegeria exitiosa*) have been continued with satisfactory results. For nursery stock the use of carbon bisulphide has been found impracticable, but tests of paradichlorobenzene have yielded promising results. Field experiments in the control of the grape-berry moth (*Polychrosis viteana*) show that the best measure is the application of 3 lb. arsenate of lead to 50 U.S. ($42\frac{1}{2}$ Imp.) gals. of water immediately after the fall of the grape blossoms. The so-called blackhead fire-worm (*Rhopobota vacciniana*) was unusually abundant and destructive on cranberries, but may be controlled by spraying infested bogs with 40 per cent. nicotine sulphate while the insects are in the larval stage.

Investigations into the arsenical and other poisonous spray residues present on fruits at harvest time, the comparative merits of dust versus liquid sprays in orchards and vineyards, and the effect on the honey bee of spraying apples with arsenicals during bloom and after the fall of most of the petals, have been carried out. It has been found that when trees in full bloom are sprayed, many bees are killed, while spraying at the customary times under normal conditions has no injurious effect.

Investigations of southern field-crop insects showed that the boll weevil (*Anthonomus grandis*) was the principal pest to be considered in relation to cotton culture. A new type of poison-dust gun and also a form of lead arsenate containing a higher percentage of arsenic

have been tested with excellent results in increased production. Further improvements in the apparatus for applying arsenate of lead against hornworms (*Protoparce*) has resulted in a more thorough application at a material reduction of cost. The storage of manufactured tobacco at a low temperature ensures an efficient and economical means of preventing loss by the cigarette beetle (*Lasioderma serricorne*). The eggs of the beetles may be sterilised by exposure to Röntgen rays [see this *Review*, Ser. A, v, p. 3]. Experiments in the control of sugar-cane insects and the Argentine ant (*Iridomyrmex humilis*) have been continued.

The section of this report on cereal and forage crop insects reviews the work done in connection with the alfalfa weevil (*Hypera variabilis*), grasshoppers, the green bug, the Hessian fly (*Mayetiola destructor*), the chinch bug (*Blissus leucoptera*), white grubs (*Lachnosterna*), the fall army worm (*Laphygma frugiperda*) and the true army worm (*Cirphis unipuncta*), wireworms, and the alfalfa-seed Chalcid (*Bruchophagus funebris*).

Of the insects affecting forest trees, the western pine beetle (*Dendroctonus brevicornis*) is reported as the most destructive, and of those affecting shade trees and hardy plants the hickory bark beetle (*Scolytus quadrispinosus*) caused the death of many hickories. Defoliation caused by cankerworm and the forest tent caterpillar (*Malacosoma disstria*), and subsequent attack by the two-lined chestnut borer (*Agrilus bilineatus*), led to the death of many oaks. A flat-headed borer is reported to have done extensive damage to the so-called Australian pine in Florida. This insect normally breeds in the red mangrove. Much damage by termites to the woodwork of buildings was reported and many documents in the U.S. Bureau of Engraving and Printing were thus destroyed. It has been found that the addition of 1 lb. sodium arsenate in 2 (U.S.) gals. of water to 1 (U.S.) gal. of stock kerosene emulsion is a most effective control of certain bark and wood-boring insects. Special attention has been given to the study of the European pine-shoot moth (*Rhyacionia buoliana*) and the European pine saw-fly (*Diprion simile*) which were accidentally introduced shortly before the plant quarantine Act became operative.

Investigations of the insect enemies of vegetable and truck crops have dealt with the insect enemies of potatoes and related plants, sugar-beet, onions, beans, peas and cruciferous and cucurbitaceous plants. Research work on the control of the spinach aphis and other Aphids by Coccinellids in Virginia is practically completed. The control of insects injurious to stored products has received further attention. Important experimental work in the control of insect pests in greenhouses has been carried out, and work has been done in the control of the Mediterranean fruit-fly (*Ceratitis capitata*) and melon fly (*Dacus cucurbitae*).

FULLAWAY (D. T.). **Report of the Division of Entomology.**—*Hawaiian Forester and Agriculturist, Honolulu*, xiii, no 12, December 1916, pp. 438–439. [Received 27th February 1917.]

During the month of November, the following parasites were reared and distributed: *Opius fletcheri* (melon fly parasite), 2,608 females and

1,720 males; 800 *Tetrastichus;* 96 *Galesus silvestrii;* 250 *Dirhinus giffardi,* 80 *D. fullawayi,* 228 *D. tryoni;* 12 *Opius humilis,* and 470 corn leaf-hopper egg-parasites.

SHINJI (G. O.). **New Aphids from California (Hem., Hom.).**—*Entom. News, Philadelphia,* xxviii, no. 2, February 1917, pp. 61–64, 2 plates.

Descriptions are given of *Thomasia californiensis,* sp. n., occurring on *Acer macrophylla* and *Myzocallis essigi,* sp. n., *M. woodworthi,* sp. n., and *M. hyalinus,* sp. n., on *Quercus.*

Osservatorio Autonomo di Fitopathologia, Turin, Mthly. Leaflets, nos. 1–12, January-December 1916, 48 pp.

These leaflets for 1916 are on the same lines as those for the preceding year [see this *Review* Ser. A, iv, p. 201]. In Piedmont the distribution of *Prospaltella berlesei* was nearly completed by April, 80,000 twigs being sent out.

The following is a brief record of some of the injurious insects:—*Acidia heraclei* on celery; *Aphis brassicae* on cabbage; *A. persicae* on peach; *A. rosae* on rose; *Aspidiotus hederae* (*nerii*) on palms and oleander; *Acrolepia assectella* on onions; *Aulacaspis pentagona* on cherry, mulberry and peach; *Asterolecanium hederae* on ivy; *Anthonomus pyri* on pear; *Hylemyia antiqua* (*Anthomyia ceparum*) on onions and garlic; *Antispila rivillei* on vine; *Balaninus nucum* on hazel; *Cydia* (*Carpocapsa*) *pomonella* on pear; *C. splendana* on chestnut; *Cassida viridis* on artichoke; *Eriocampoides* (*Caliroa*) *limacina* on pear; *Janetiella* (*Cecidomyia*) *oenophila* on vine; *Cephus pygmaeus* on wheat; *Cheimatobia brumata* on quince; *Chionaspis euonymi* on *Euonymus*; *Chrysomphalus dictyospermi* on *Chamaeodorea* sp.; *Clysia ambiguella* on vine; *Coccus hesperidum* on lemon and mandarine; *Cossus cossus,* in walnut; *Scolytus* (*Eccoptogaster*) *rugulosus* on plum; *S.* (*E.*) *multistriatus* on elm; *Eryophyes pyri* on pear; *Euproctis chrysorrhoea* on chestnut, cherry, hazel and oak; *Eryophyes vitis* on vine; *Epidiaspis piricola* on pear; *Olethreutes* (*Grapholitha*) *variegana* on cherry; *Cydia* (*G.*) *funebrana* on apricot and plum; *Hyalopterus pruni,* on plum; *Hyponomeuta malinellus* on apple; *Bruchus* (*Laria*) *rufimanus* on beans; *Eulecanium* (*Lecanium*) *coryli* on hazel; *Lepidosaphes ulmi* (*pomorum*) on willow, pear and apple; *Cirphis* (*Leucania*) *zeae* on maize; *Magdalis pruni* on apricot; *Barathra* (*Mamestra*) *brassicae* on lettuce; *Micronematus abbreviatus* on pea; *Monarthropalpus buxi* on box; *Neurotoma flaviventris* on pear; *Perrisia pyri* on pear; *Platyparea poeciloptera* on asparagus; *Phloeothrips oleae* on olive; *Phleosinus thujae* on thuja; *Phylloxera vastatrix* on vine; *Polychrosis botrana* on vine; *Pseudococcus vitis* on vine; *Byctiscus betulae* (*Rhynchites betuleti*) on pear; *Saissetia oleae* on oleander; *Eriosoma* (*Schizoneura*) *lanigerum* on apple; *Aegeria vespiformis* (*Sesia asiliformis*) on poplar; *A.* (*S.*) *tipuliformis* on currant; *Hemerophila* (*Simaethis*) *nemorana* on fig; *Sitotroga cerealella* on wheat; *Tetranchyus telarius* on pear and vine; *Tinea granella* on wheat; *Stephanitis* (*Tingis*) *pyri* on pear and apple; *Tenebroides* (*Trogosita*) *mauritanicus* on maize; *Xyleborus dispar* on apple; *Zeuzera pyrina* (*aesculi*) on apple.

Grandi (G.). **Contributo alla conoscenza degli Agaonini (Hymenoptera, Chalcididae) di Ceylon e dell' India.** [A Contribution to the Knowledge of the Agaoninae of India and Ceylon.]—Separate, dated 28th December 1916, from *Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric., Portici,* xi, pp. 181–234, 20 figs.

This paper describes the following species of Agaoninae infesting figs:—From Ceylon—*Ceratosolen fuscipes,* Mayr, from *Ficus glomerata,* and *Blastophaga gestroi,* Grnd., *Eupristina grassii,* sp. n., *Sycophaga brevitarsus,* Grnd., and *Apocrypta westwoodi,* Grnd., the hosts of which are not known, though in Java, *A. westwoodi* occurs in *Ficus glomerata.* From India—*Ceratosolen gravelyi,* Grnd., from *Ficus cunia,* and *Eupristina saundersi,* sp. n., from *F. religiosa* and *F. retusa.*

Grandi (G.). **Contributo alla conoscenza degli Agaonini (Hymenoptera, Chalcididae) di Giava.** [A Contribution to the Knowledge of the Agaoninae of Java.]—Separate, dated 17th January 1917, from *Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric., Portici,* xii, pp. 1–60, 21 figs.

A description is given of the following Agaoninae from Java:—*Blastophaga puncticeps,* Mayr, from *Ficus fulva*; *B. puncticeps distinguenda,* Grnd; *B. boldinghi,* Grnd., from F. *lanata*; *B. valentinae,* Grnd., from *F. cuspidata*; *B. jacobsoni,* Grnd., from *F. procera*; *Ceratosolen striatus,* Mayr, and *C. striatus notandus,* Grnd., from *F. variegata*; *C. crassitarsus,* Mayr, from *F. ribes*; *Eupristina emeryi,* Grnd.; *E. koningsbergeri,* Grnd., from *F. beniamina*; *Sycophaga spinitarsus,* Mayr, from *F. variegata*; and *S. tristis,* Grnd., from *F. glomerata.*

Miller (M. R.). **Analyses of Some More Recent and Older Pest Remedies.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vi, no. 1, January 1917, pp. 23–26.

This article contains analyses of various insecticides, including Bordeaux paste, Bordeaux mixture, dry powdered crude carbolic acid, chloride of lime, formaldehyde fumigator, lead arsenate, dry-powdered lime-sulphur solutions, Paris green, soluble sulphur, atomic sulphur and California scale spray, as well as of a number of proprietary compounds.

Hecke (G. H.). **Two New Pests to be watched for.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vi, no. 1, January 1917, pp. 33–34.

The moth, *Cydia* (*Laspeyresia*) *molesta,* has been recorded in the Eastern United States [see this *Review,* Ser. A, v, pp. 75, 130], and is believed to have been imported from Japan. A short description of the damage done by this insect is given. While principally an enemy of peaches, it may attack plum, cherry or almond trees. The second pest recorded is a fungus disease of poplars and cottonwoods.

MASKEW (F.). **Quarantine Division.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vi, no. 1, January 1917, pp. 36–38.

The following pests were intercepted during November 1916:—From Belgium: Larvae of a leaf-miner, *Thrips* sp., and *Aleurodes* sp., on azaleas; *Trioza alacris, Aspidiotus britannicus, A. hederae*, and *Coccus hesperidum* on bay trees. From Central America: *Selenaspidus articulatus* and *Aspidiotus* sp. on bananas, and weevil larvae in avocado seeds. From China: *Cladosporium citri* and *Parlatoria ziziphus* on oranges, *Cylas formicarius* in sweet potatoes, and *Calandra oryzae* in rice. From Colombia: *Diaspis boisduvalli* on orchids. From Costa Rica: *Lepidosaphes beckii* on oranges. From Hawaii: *Diaspis bromeliae* and *Pseudococcus* sp. on pine-apples; *Coccus longulus* on betel leaves; *Chrysomphalus aonidum, Hemichionaspis minor* and *Pseudococcus* sp. on bananas; Trypetid larvae in string beans; *Cryptorrhynchus batatae* in sweet potatoes; Lepidopterous larvae in dates; *Lepidosaphes beckii* on oranges. From Holland: Larvae and pupae of *Merodon equestris* in narcissus bulbs, and *Lepidosaphes ulmi* on *Buxus*. From Japan: Weevil larvae in chestnuts, a Coccid on oranges, Lepidopterous larvae in Chili peppers, and pine-cone and unidentified weevils on chestnuts. From New Jersey: *Isosoma orchidearum* on orchids. From Pennsylvania: *Pseudococcus* sp. on gardenia, begonias, coleus, cyclamens, fuchsias and spiraea, and *Dialeurodes citri* on *Citrus* sp. From Florida: *Chionaspis* sp. on pineapple, and *Saissetia oleae* on avocado. From Maryland: *Aspidiotus perniciosus* and *Cydia pomonella* on apples. From Mexico: Lepidopterous larvae in dates, *Lepidosaphes gloveri* on limes and oranges, and *L. beckii* on oranges. From Mississippi: *Aleurodes citri* on gardenia. From New York: *Diaspis boisduvali* and *Eucalymnatus perforatus* on orchids, *Aspidiotus perniciosus* on apples, *Pseudococcus citri* on Otaheite orange, and *A. lataniae* on *Jasminum primulinum*. From Washington: *Rhizoctonia* on potatoes.

VEITCH (R.). **The Sugar-cane Wireworm in Fiji** (*Simodactylus cinnamoneus*, **Boisd.**)—*Colonial Sugar-Refining Co., Agric. Rept. no. 1, Sydney*, December 1916, 16 pp., 1 plate. [Received 2nd March 1917.]

Of the wireworms in the cane-fields in Fiji, 99 per cent. are the Elaterid, *Simodactylus cinnamoneus. Lacon stricticollis*, Fairm., also occurs, but much less abundantly, while a third, unidentified species is regarded as a beneficial insect because it destroys large numbers of the white grubs of *Rhopea vestita*, Arr. The female of *S. cinnamoneus* deposits eggs in clusters of 20 or 30 in cavities made in lumps of slightly moist earth. The larva hatches out in 15 to 19 days, according to the temperature, and occurs in this stage for two or probably three years, feeding on the eyes, roots and butts of the canes, frequently tunnelling up the centre of the young shoots and killing them. It also attacks roots of grasses, weeds and maize, being especially prevalent in rich, alluvial soils. When full-grown and after many successive moults, the larva pupates in the soil, and in about 10 days the adult emerges. The insect in the larval stage, which is the only dangerous period, is very difficult to control; it appears to be free from parasites and predaceous enemies, and is capable of enduring prolonged fasts. As a

preventive measure, stress is laid on the necessity for clean cultivation and care of the young cane in order to stimulate rapid growth and enable the plants to resist attack. As a control, poison experiments have been carried out with negative results, the wireworms being apparently very resistant. This method is being further investigated.

Entomologie. [Entomology].—*Bull. Soc. Nat. d'Acclimatation, Paris,* lxviv, no. 3, March 1917, pp. 87–88.

In the Department of Seine and Marne in 1916 cabbages were damaged by Pierid caterpillars. The destruction was greatest in September, but was probably not as severe as it might have been owing to their being very largely parasitised, mainly by *Microgaster glomeratus.*

LEGISLATION.

Ordinance relating to the Coconut Beetle in Samoa:—British Military Occupation of Samoa, Proclamation no. 6, 1914. [Received 13th February 1917.]

This Proclamation, issued 19th December 1914, supplements the Coconut Beetle Ordinances of 19th April 1911, and orders that no new planting or cultivation of any lands shall be made without permission in writing of the Inspector appointed by the Coconut Beetle Commission; such permission will only be given subject to the burning and destroying of all dead wood which is likely to provide breeding places for the insect. Any complaint against the decision of the Inspector must be made in writing to the Commission within 10 days from the date of the decision. Any contravention of these orders entails a fine not exceeding 40 shillings for each acre so planted, and in the event of enforcement of the Ordinance of 1911 no damage can be claimed for destruction of young plants.

Ordinance relating to the Destruction of the Coconut Beetle in Samoa: —British Military Occupation of Samoa, Proclamation no. 19, 1915. [Received 13th February 1917.]

Under date of the 6th August 1915, the Administrator of Samoa has issued an order providing that all labourers employed upon any plantation shall devote the working hours of the forenoon of every Monday exclusively to the search and destruction of all stages of the coconut beetle (*Oryctes nasicornis*) throughout the whole of the infested portions of their land, and a return shall be rendered to the Inspector by the owner, showing the result of the search. Every owner of infested lands is held personally responsible for the carrying out of these measures. The Administrator may exempt from the provisions of this order any plantations which he is satisfied are free from infestation, and any labourers employed in special capacities

upon plantations. Any offence or default under this Ordinance is punishable by a fine not exceeding £50, or by imprisonment for not more than six months.

RITCHIE (A. H.). **Black-fly of Citrus.**—*Jl. Jamaica Agric. Soc., Kingston,* xx, no. 12, December 1916, p. 481.

The State Plant Board of Florida has declared the spiny black-fly of citrus (*Aleurocanthus woglumi*) to be a pest and has forbidden the importation into Florida of all trees, plants, vines, shrubs, cuttings, scions, leaves and parts of plants from the Bahamas, India and Jamaica. Timber, sisal hemp or manufactured articles, as well as fruit and vegetables, against which there is no other prohibitive order, are not included. This order has arisen as the result of the occurrence of this Aleurodid in the Bahamas, where it was mistaken for citrus canker.

An Ordinance to amend the Plant Protection Ordinance 1911.—No. 37, 11th December 1916, *Port of Spain,* 2 pp.

Section 2 of the Plant Protection Ordinance, 1911 (Trinidad and Tobago), is amended, a "Pest" now being defined as: "any parasitical, epiphytal or other animal or vegetable organism and also any insect or other invertebrate animal (in whatever stage of existence such insect or animal may be), affecting or injurious to trees, shrubs or herbs, which the Governor may by proclamation from time to time declare to be a pest within the meaning of this Ordinance."

Section 5: "The Locust Destruction Ordinance (No. 124), the Parasol Ants Ordinance (No. 125) and the Locust Destruction Ordinance, 1907, are hereby repealed."

California State Commission of Horticulture Quarantine Order No. 29 (with Regulations). Alfalfa Weevil.—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vi, no. 1, January 1917, pp. 31–32.

Quarantine Order No. 20 has been revoked and replaced by Quarantine Order No. 29, dated 29th December 1916. The full text of the regulations provided by this order concerning the alfalfa weevil, *Hypera variabilis* (*Phytonomus posticus*), is given. The total absence of any evidence that either bees in the hive or lucerne seed imported from Utah or the States of Idaho and Wyoming, constitute a menace has led to these being struck off the quarantined or restricted list. The regulations regarding potatoes and the belongings of agricultural emigrants materially strengthens the quarantine against affected States.

Pineapple Weevil.—Separate from *Jamaica Gazette, Kingston,* xl, no. 4, 25th January 1917. [Received 28th March 1917.]

Owing to the presence of the pineapple weevil (*Metamasius ritchiei*) in Jamaica, the importation of pineapple slips into the Bahamas from that island has been prohibited.

NOTICES.

Secretaries of Societies and Editors of Journals willing to exchange their publications with those of the Bureau, are requested to communicate with the Assistant Director.

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THE REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

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TROOP (J.). **Report of the Entomological Department.**—*Twenty-ninth Ann. Rept. for the Year ending June 30, 1916.—Purdue Univ. Agric. Expt. Sta., Lafayette, Ind.*, pp. 41–42. [Received 6th March 1917.]

The year 1916, as a whole, was comparatively free from serious outbreaks of insects. The Hessian fly [*Mayetiola destructor*] continued to do considerable damage to wheat, especially in the south of the State; in other sections its parasites developed to such an extent that they reduced the damage done to a minimum. An unusual outbreak of flea-beetles on maize occurred, the plants being attacked when from two to four inches high. The beetles were also very numerous on potatoes. In the course of work on the control of the codling moth [*Cydia pomonella*] it was found that the emergence of a brood of the adults was spread over a period of more than two weeks, and it was decided to begin the application of sprays in the middle of this period.

WOODBURY (C. G.), RICHARDS (M. W.) & READ (H. J.). **The Indiana Farm Orchard, Operating Costs and Methods.**—*Purdue Univ. Agric. Expt. Sta. Bull., Lafayette, Ind.*, xix, no. 194, September 1916, 79 pp., 56 figs., 12 tables. [Received 6th March 1917.]

Two classes of insects attack fruit trees; sucking insects, such as Aphids and Coccids, which extract their food from the sap of the tree; and chewing insects, which actually eat parts of the fruit or leaves. The former must be controlled by a contact insecticide, and the latter principally by stomach poisons, of which arsenate of lead is the one most commonly used in orchards. The winter or dormant spray is a contact insecticide and is applied as a sanitary measure and for the control of scale-insects between November and March. Lime-sulphur should be used at a strength of about 5° Bé. There are also reliable miscible oil sprays that may be used, but these are more expensive. The standard summer sprays are lime-sulphur, Bordeaux mixture and arsenate of lead. Nicotine sulphate is added, when the occasion demands, for soft-bodied insects such as Aphids. The first summer spray, for which Bordeaux mixture (4–6–50) is used and to which one pound of powdered arsenate of lead or two pounds of paste arsenate of lead to 50 U.S. ($42\frac{1}{2}$ Imp.) gals. of mixture is added, should be applied when the leaf-buds burst and before the flower-buds open. The second summer spray, which is specially directed against the first brood of codling moth [*Cydia pomonella*], should consist of lime-sulphur 1° Bé., to which arsenate of lead is added in the same proportion as in the first summer spray, and should be applied as soon as the petals fall. When Aphids are present, nicotine sulphate should be added in the proportion of one-third pint of nicotine sulphate to every 50 U.S. gals. of spray solution. The third summer spray, which is also directed against *C. pomonella*, may be a repetition of the first summer spray and is applied about three weeks after the petals fall. The fourth summer spray is also the same as the firsth and is applied at the end of June or the beginning of July. The fifth summer spray is directed against the late brood of *C. pomonella* and should be applied about three or four weeks after the last, the same mixture being used.

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Full directions are given for making Bordeaux mixture, lime-sulphur solution, and arsenate of lead sprays. Instructions are given in the use of the hydrometer, with a dilution table. Advice is also given as to the best manner in which to apply the spray and the best type of machinery to use, according to the size of the orchard to be treated. Tables show the cost of spraying orchards in various parts of the State.

SAYRE (C. B.). **Commercial Onion Growing.**—*Purdue Univ. Agric. Expt. Sta., Lafayette, Ind.*, Circular no. 57, September 1916, 25 pp. 12 figs. [Received 6th March 1917.]

The onion thrips [*Thrips tabaci*] causes considerable damage to onions every year, especially in dry seasons. It may be controlled by spraying at high pressure with a nozzle producing a fine mist-like spray which can be directed into the base of the onion leaves. The mixture recommended consists of 5 oz. concentrated nicotine sulphate, 4 lb. whale-oil soap, and 50 U.S. (42½ Imp.) gals. of water. This should be applied when the thrips first appear and the onions are small and easily sprayed. Two or three sprayings at intervals of ten days may be necessary to destroy succeeding generations as they hatch. A gasoline outfit or good hand-pump with a long line of hose and extension rod is advised. Onion maggots [*Hylemyia antiqua*] also cause more or less damage every year. The removal and burning of infested plants is an important measure of control. The plants may also be sprayed as soon as they come up, with a mixture of 1 oz. of sodium arsenate, 2½ U.S. quarts of molasses and 5 U.S. (4¼ Imp.) gals. of water. The arsenate should be dissolved in boiling water and the molasses added and thoroughly mixed. It may be applied with a whisk broom or with a sprayer, using a coarse nozzle, as the object is to form large drops at which the flies may drink and so be poisoned. Once the plants have become infested, no remedy is effective during the current season, but by burning as many infected plants as possible, the number of insects that will appear the following year may be reduced, and the poisoned bait can be applied before the flies have had an opportunity to lay their eggs.

Cutworms are most effectively controlled by means of poisoned bait. A mixture of 50 lb. of wheat, bran or middling, 2 lb. of Paris green and 6 finely chopped oranges or lemons, with enough molasses and a little water to make a stiff dough, is advised. Lumps of this mixture, about the size of a marble, should be scattered round the infested area, preferably in the late afternoon, as cutworms are night-feeders and the bait will not have had time to dry before they appear to feed.

The Coconut Beetle (*Oryctes nasicornis*) in Samoa.—*Report of the Commission of Enquiry concerning the Coconut Beetle in Samoa, Malua*, 1916, 60 pp. [Received 6th March 1917.]

The evidence shows that the present situation as regards this beetle in Samoa is worse than it was in the previous year, a much larger area being affected than in former years, though it is not proved that the actual damage inflicted has been more severe than previously. It is doubtful whether the wholesale cutting down of trees in infested

plantations has been wise, as the result undoubtedly has been to drive the beetle farther afield, while if some of the damaged trees had been allowed to stand, they might have acted as traps and confined the pest to a smaller area. The decreased output in the year under review, which has erroneously been attributed solely to the effects of the beetle, has been due in a large measure to three severe storms followed by a drought. In considering suggestions for control, the necessity for clean lands is emphasised, all rubbish, rotten wood, etc., being ideal breeding-places for the beetle. Regarding the utility of Dr. Friederich's fungus, the evidence is very contradictory, but obviously this method is both slow in operation and expensive, and requires expert manipulation. It is, however, the opinion of the Commission that, should scientific methods be adopted, a proper and well-sustained trial of this fungus should be made. In an addendum, the mycologist at Peradeniya, Ceylon, reports that efforts to infect the larvae of the beetle with this fungus have failed there, even under the most favourable conditions. As *Oryctes nasicornis* shows a preference for wild palms rather than coconuts and has been found abundantly in the virgin bush, it is very doubtful whether the island can ever be totally cleared of the pest. Possibly a liberal cultivation of wild palms on the fringes of plantations might protect to some extent the cultivated variety, while it may be found necessary to clear the virgin bush of breeding-places. The evidence proves that pigs are of great value as destroyers of larvae and, wherever possible, they should be allowed to run free in the plantations. The evidence also shows that where cattle are present lands are clean.

Legislation should be introduced requiring planters to obtain permits before opening new clearings or cutting down bush. Suggestions were constantly made in the evidence as to the desirability of the introduction of a natural enemy to control this beetle, but this would involve the engagement of a staff of entomologists for the purpose of finding a suitable parasite. Unfortunately, those who have been studying the palm-destroying insects for years have so far failed to find any natural enemy which would be useful as a control. The necessity for thorough and systematic search for beetles and larvae on the part of the natives is insisted upon. The Commission is of the opinion that more European inspectors should be appointed, and these, in the event of their not being satisfied with the search effected by plantation owners, should be empowered to issue permits to natives to carry out this work.

South (F. W.). **Summary of Locust Work for the 3rd Quarter 1916.** —*Agric. Bull. Fed. Malay States, Kuala Lumpur,* v, no. 3, December 1916, pp. 64–72, 1 table. [Received 6th March 1917.]

At the date of issuing this quarterly report the work for the season had not been concluded. Practically the whole period was occupied with destroying the very large generation of locusts which hatched out in the States of Negri Sembilan, Malacca and Johore. Good work was done in the first two districts, but, owing to local difficulties which hampered the work in some centres, some swarms escaped, more especially in Johore. Several swarms may therefore be expected in this State during the coming quarter. A table is given showing

the localities in which the swarms occurred, the dates of their occurrence, the number of swarms driven, and the number poisoned. The total number of swarms poisoned in Negri Sembilan amounted to 1,074, and in Pahang to 67; while the number of swarms driven in Malacca totalled 2,425 and those in Johore, including those burnt and the breeding grounds of which were flooded, amounted to 573, making a grand total of 4,139. Five breeding grounds were also flooded in Malacca.

Montandon (A. L.). **Hemiptères de la Basse-Egypte. 1. Geocorinae.** [Hemiptera of Lower Egypt. 1. Geocorinae.]—*Bull. Soc. Entom. d'Egypte, Cairo*, ix, no. 2, April–June 1916, pp. 38–51. [Received 6th March 1917.]

This paper describes the Egyptian species of this sub-family of Lygaeidae and deals with the genera *Piocoris*, *Geocoris*, *Mallocoris* and *Stenophthalmicus*, the results of the author's observations on several species being recorded.

Willcocks (F. C.). **Some Notes on the Mealy Plum Aphid,** *Hyalopterus pruni*, **F.**—*Bull. Soc. Entom. d'Egypte, Cairo*, ix, part 2, April-June 1916, pp. 33–37. [Received 6th March 1917.]

Hyalopterus arundinis (*pruni*) is prevalent in Egypt in the spring on apricot and peach trees, and has a wide distribution. The eggs are laid chiefly in the axils of leaf-buds, and are covered with a coat of white waxy filaments; they hatch in February or March, giving rise to the stem-mothers, and these produce asexually large numbers of living young which surround them in a compact colony on the under side of a leaf. These asexual generations continue until about the beginning of April, when a winged generation of asexual females appears, which spread to other trees, and it is probably this generation that migrates to the reed-grass, *Phragmites communis*, which is the alternative host-plant. Here the Aphids establish themselves on the upper side of the leaves, in contrast to the position adopted on apricot and peach. In the autumn a sexual generation of winged males and wingless oviparous females appears on the trees, thus completing the life-cycle. On apricots very little damage apparently is caused, but on peaches the injury is more serious, causing curling and malformation of the leaves. The attack is most severe in April and then gradually wanes, owing to the Aphids being destroyed by parasites, until towards the end of May, when the trees are frequently cleared of the pest.

As a control measure, a spray of paraffin emulsion is effective, when applied in the early stages of the attack, but not when the trees are in bloom. Trees which have received a winter spraying of lime, salt and sulphur to check scale-insects are less liable to attack by this aphis. This wash probably acts mechanically in preventing the hatching of the stem-mothers, and also kills numbers of those which do succeed in emerging. The alternative host-plant, *Phragmites communis*, should be destroyed as far as possible.

GEORGESON (C. C.). **Report of the Alaska Agricultural Experiment Stations 1915.**—*U. S. Dept. Agric., Washington, D.C.*, 24th November 1916, pp. 41–42. [Received 8th March 1917.]

The cabbage maggot, *Chortophila* (*Pegomyia*) *brassicae*, is the worst pest of horticulture at the Sitka Station. Tarred felt disks were used as a method of control for Cruciferous plants, but were not suitable for such plants as turnips or rutubagas, which consequently suffered considerably. A Lepidopteron that damaged apples to some extent is being identified, but is suspected to be *Agryresthesia conjugella*, which is especially abundant in Norway and Sweden and is known in British Columbia. It probably may be controlled by the same methods that are used against codling moth [*Cydia pomonella*]. A green aphis has been troublesome in green-houses, but was controlled by fumigation with nicotine paper. The climate is too damp for Aphids to thrive in the open.

URBAHNS (T. D.). ***Tetrastichus bruchophagi*, a recently described Parasite of *Bruchophagus funebris*.**—*Jl. Agric. Research, Washington, D.C.*, viii, no. 7, 12th February 1917, pp. 277–282, 1 plate.

The Eulophid, *T. bruchophagi*, Gahan, has recently been reared from *B. funebris* infesting lucerne over a widely distributed area in California. It is probably the first of the parasites of *B. funebris* to appear in the field in early spring, searching over the green seed-pods for seeds infested by its host. The female forces the ovipositor through the seed-pod and into the infested seed, placing an egg upon the larva within. When the parasitic larva is fully grown, it enters upon a dormant period, which lasts not less than about 10 days, and may continue until conditions for pupation are favourable; this stage sometimes includes hibernation, the pupa being formed in the following spring. The length of the pupal stage varies from 6 to 35 days. The adult, upon emergence, finds itself completely enclosed within the seed which has been hollowed out by its host. It gnaws a small hole through the seed wall and through the seed-pod and thus makes its escape. Under favourable conditions, there are from 2 to 4 generations in a season. In California the parasite is of considerable importance, destroying about 50 per cent. of the larvae of its host on lucerne. In Arizona, however, it is at present of very little importance.

PARROTT (P. J.) & HODGKISS (H. E.). **Miscellaneous Notes on Injurious Insects.**—*N. Y. Agric. Expt. Sta., Geneva*, Bull. no. 423, August 1916, pp. 359–387, 8 plates, 4 figs. [Received 9th March 1917.]

Among minor fruit pests in New York, the orchard ermine moths, *Hyponomeuta malinellus*, Z., and *H. padellus*, L., are being introduced in large numbers into this State by importations of foreign-grown nursery stock. In 1915 the number of localities affected exceeded previous records, but the infestations were largely confined to apple seedlings. The leaf weevil (*Anametis granulata*, Say) has a wide range of distribution. It has not been recorded in destructive numbers of late years, and, when recorded, has only been found attacking nursery

trees soon after transplanting into orchards. These trees were protected with mosquito netting. A timely application of arsenate of lead would probably be effective. The lesser peach borer, *Aegeria* (*Synanthedon*) *pictipes*, G. & R., is apparently not on the increase. The usual control measures against this moth are given [see this *Review*, Ser. A, ii, p. 432]. The lime-tree winter-moth (*Erannis tiliaria*, Harr.) usually persists from year to year in woods unnoticed. It occasionally becomes numerous and causes serious defoliation both in the woods and adjacent orchards. As it has not been found in injurious numbers in well-sprayed orchards, the prevailing system of treatment with arsenicals probably affords sufficient protection against this pest. The gooseberry fruit worm (*Zophodia grossulariae*, Pack.) sometimes attacks currants and also greengages. The control measure which has been found effective is the application of a spray of arsenate of lead or Paris green as the first webs are being formed. In an effort to correlate the different green fruit worms on apple with the moths of the various species, specimens of a common type in one orchard were reared to maturity and proved to be *Graphiphora alia*, Guen. A description of the egg and larval stages of this moth are given.

SEVERIN (H. H. P.). **Soluble Poisons in the Poisoned Bait Spray to control the Adult of the Apple Maggot** (*Rhagoletis pomonella*, **Walsh**).—*Maine Agric. Expt. Sta., Orono*, Bull. 251, April 1916, pp. 149–168. [Received 9th March 1917.]

This paper describes in detail a number of experiments with various poison-bait sprays, the results of which are given in a series of tables. Experiments carried out in 1914 showed that soluble poisons, such as potassium and sodium arsenate and sodium arsenite, even when used in such small quantities as $\frac{1}{4}$ oz. added to three gallons of water and one pint of molasses, will scorch the foliage of apple trees. In experiments in the following year three applications of poisoned bait spray containing soluble poison dissolved in diluted molasses showed that infestation varied from 0 to 20 per cent. in orchards situated away from the margin of the experimental area, and from 32 to 57 per cent. in orchards near untreated trees. An even distribution of the droplets over the foliage proved more effective than spraying the trunk and large limbs from underneath. Definite information has not yet been obtained regarding the number of applications necessary for good results. In orchards where tent-caterpillars [*Malacosoma*] have already partly defoliated the trees, a soluble poison should not be used.

This remedy has been a complete failure in the control of *Rhagoletis pomonella* under town conditions. With four applications of the spray the infestation varied from 4 to 98 per cent.

METCALF (C. L.). **Syrphidae of Maine.**—*Maine Agric. Expt. Sta., Orono*, Bull. 253, July 1916, pp. 193–264, 9 plates. [Received 9th March 1917.]

This paper describes in a popular manner the structure and habits of various species of SYRPHIDAE which are among the most important natural enemies of Aphids. These include :—*Paragus angustifrons*,

Lw.; *Pipiza pisticoides*, Will.; *Melanostoma mellinum*, L.; *Sphaerophoria cylindrica*, Say; *Syrphus americanus*, Wied.; *S. ribesii*, L.; *S. torvus*, O.S.; *S. xanthostomus*, Will.; *S. nitens*, Zett.; and *Didea fasciata* var. *fuscipes*, Lw. Almost all the species occurring in Maine have been found to be beneficial. Practical measures are suggested for the protection of these flies, and experiments are being carried on which indicate that certain contact insecticides which will not kill Syrphid larvae can be used to kill Aphids. In laboratory tests a solution of Black Leaf 40, 1 to 1,000 parts of water, with soap added, killed every Aphid and only a small percentage of Syrphids. Besides attacking Aphids, these flies are predaceous upon Coccids, and young individuals of Aleurodids, Jassids, Psyllids and Membracids. A few species occasionally cause serious injury to cereal crops, the most important being *Mesogramma* (*Toxomerus*) *polita*, which occurs on maize in many of the American States, but has not yet been found in Maine. *Eristalis tenax*, *E. diniatus* and *E. arbustorum* have been known to occasion myiasis in man and animals, but such cases are very rare. Keys are given to the larvae and pupae of the various species.

A bibliography of 66 works is given.

Trabut (—). **La Galle du *Tamarix articulata* dite Tak'out au Maroc.** [The Gall of *Tamarix articulata*, called Tak'out in Morocco.]—*Bull. Soc. Hist. Nat. Afrique Nord, Algiers*, iii, no. 2, 15th February 1917, pp. 29–30.

A description is given of a mite, a species of *Eriophyes*, which occurs on *Tamarix articulata* in Morocco. The gall formed by it is used for tanning, as it contains more than 50 per cent of tannin.

Cros (A.). **Résistance vitale des larves de *Stratiomyia anubis*, Wiedemann.** [Tenacity of Life of Larvae of *Stratiomyia anubis*, Wied.]—*Bull. Soc. Hist. Nat. Afrique Nord, Algiers*, iii, no. 2, 15th February 1917, pp. 31-41.

Experiments are described showing the extraordinary tenacity of life of the larvae of the fly, *Stratiomyia anubis*, Wied., when subjected to the action of such substances as ether, cyanide of potassium, alcohol, benzine and petroleum. It is also stated that some larvae and even adults of *Drosophila rubrostriata*, Beck., enclosed in sealed vessels containing the heads of negroes preserved in formol, and sent from German East Africa, were alive when they reached Europe.

Minod (M.) & Baltzinger (G.). **Notes sur la Cochylis et sur le Mildiou.** [Notes on *Clysia ambiguella* and Mildew.]—*Rev. de Vitic., Paris*, xlvi, no. 1177, 18th January 1917, pp. 37–42. [Received 15th March 1917.]

During a tour of inspection through several vineyards in the cantons of Vaud and Geneva, it was found that in the higher vineyards round Vevey the damage caused by *Clysia ambiguella* was not so severe as in those at lower altitudes. Just above the lake of Geneva the vineyards at an altitude of about 1,200 feet were very severely attacked, but in those at Vignette the trellises above the vineyards were more severely attacked than the vineyards themselves, which were not so sheltered as the trellises placed against a southern wall. It

would appear that the adults of the second generation preferably oviposited on the grapes of the most exposed portion of this trellis. This vineyard was also severely attacked by mildew and brown rot. Vineyards treated with golazine or with arsenic showed no advantage over untreated ones used as controls. Tables are given to show the amount of damage that may be caused by this moth, and the habits of the larva and the way in which it destroys the grapes are described. It is pointed out that none of the insecticides at present in use against it appear to give very satisfactory results.

Serre (P.). **L'Ile de la Trinité menacée d'une invasion de Sauturelles.** [The Island of Trinidad threatened by an Invasion of Locusts.]—*Bull. Mus. National Hist. Nat., Paris*, no. 2, 1916, pp. 101–104. [Received 16th March 1917.]

A description is given of the threatened invasion of Trinidad in 1915 by locusts from Venezuela, where they had caused considerable damage [see this *Review*, Ser. A, iv, pp. 92, 170].

The best control measures recommended are the spraying of plants with arsenical compounds composed of 4 lb. of paste arsenate of lead to 50 gals. of water and 4 lb. of quick lime; or 1 lb. of white arsenic and 4 lb. of carbonate of soda dissolved in 1 gal. of boiling water added to 50 gals. of water containing 3 lb. of quick lime and 1 gal. molasses; or the more practical method of spreading poisoned bait containing white arsenic or the arsenates of soda or lead. This bait is made by mixing 2½ lb. of white arsenic, 50 lb. of sawdust, 6 chopped, bitter oranges or lemons, 4 lb. of molasses and 5 gals. of water. Sufficient water is then added to render the whole of a convenient consistency.

It is also suggested that an attempt should be made to infect with *Coccobacillus acridiorum* the locusts all along the shores of the Gulf of Paria, so as to form a barrage in which those coming from the interior of Venezula would become infected and thus prevented from reaching Trinidad. In order to be effective, the campaign should be carried out throughout all the districts of Venezuela invaded by *Schistocerca americana* and continued for two or three years.

Only two species of non-migratory locusts are found in Trinidad; *S. praesignata* and the giant locust, *Tropidacris dux*, which is not prolific and has many natural enemies. Experiments made on the last species with *Coccobacillus acridiorum* showed that the virus killed after 36 hours at the first passage and in 18 hours at the second. At the height of its virulence it caused death in 4–6 hours.

P. L. **Un Congrès contre les Sauterelles.** [A Congress against Locusts.]—*Rev. de Vitic. Paris,* xlvi, no. 1182, 22nd February 1917, p. 123.

It has been decided by the International Institute of Agriculture, on the suggestion of the Agricultural Service of Morocco, to call an international conference to discuss methods of controlling locusts.

South Africa and South America have adopted international regulations for combating the primary foci of locusts, and it is to be hoped that the initiative taken by the Morocco Protectorate will lead to a mutual understanding in the northern hemisphere.

DEGRULLY (L.). **Efficacité comparée des Bouillies bordelaises acides et alcalines.** [The relative Efficacy of acid and alkaline Bordeaux Mixtures.]—*Progrès Agric. Vitic., Montpellier*, lxvii, no. 7, 18th February 1917, pp. 149–154.

In the course of a series of experiments with Bordeaux mixture used as a fungicide it was found that by using a good alkaline mixture, the amount of copper could be reduced by at least one-third, without in any way diminishing the efficacy of the spray. Even if the acid mixtures be considered more efficient at the moment of their application, their action is necessarily ephemeral, as they are quickly and easily washed off by rain, while the alkaline solutions are far more adherent. The usual objection raised against the use of alkaline mixtures, in that the free lime affects the solubility of the reserve copper, is discussed, but this is not considered a serious objection in practice.

VERMOREL (V.) & DANTONY (E.). **Les bouillies acides et les bouillies alcalines.** [Acid and alkaline Mixtures.]—*Progrès Agric. Vitic., Montpellier*, lxvii, no. 9, 4th March 1917, pp. 201–207.

This paper gives a detailed account of the experiments with acid and alkaline Bordeaux mixtures referred to above.

HÉRON (G.). **Bouillies acides et bouillies alcalines.** [Acid and alkaline Mixtures.]—*Progrès Agric. Vitic., Montpellier*, lxvii, no. 10, 11th March 1917, pp. 228–230.

The author differs from the conclusions arrived at in the preceding papers and considers that acid mixtures are more effective as fungicides.

RAÑA (I.). **Cura de los Arboles con ácido cianhídrico.** [Treatment of Trees with Hydrocyanic Acid.]—*Gaceta Rural, Buenos Aires*, x, no. 115, February 1917, p. 405.

The following formula, which has been used with good results in Buenos Aires, is recommended for fumigating orange-trees: for every 40 cubic feet of the fumigating tent which covers the tree allow $\frac{2}{3}$ oz. of ferrocyanide of sodium, and 1 oz. of sulphuric acid diluted in water to 25 per cent. This mixture should be boiled over an alcohol heater in the tent for 30 or 40 minutes for a medium-size tree. If alcohol has been used in the heater in the proportion of $\frac{1}{4}$ pint to 5·20 cubic feet of space in the tent, the fire will then be burnt out and the tent can be removed, the operator remaining on the windward side so as to avoid the fumes. Such fumigation should destroy all insects that it reaches and can be employed at any time except when there are young shoots or leaves on the trees.

MAYHEUX (G.). **The Inspection of Nurseries.**—*Agric. Gaz. Canada, Ottawa*, iv, no. 2, February 1917, pp. 132–134.

The object of the legislation concerning the inspection of nurseries which was sanctioned on 19th February 1914 is explained in this article, as well as its organisation and administration. The black list

of insects and diseases given in the act includes San José Scale (*Aspidiotus perniciosus*, Comst.), brown-tail moth (*Euproctis chrysorrhoea*, L.), gipsy moth (*Lymantria* (*Porthetria*) *dispar*, L.), woolly aphis (*Eriosoma* (*Schizoneura*) *lanigerum*, Hausm.), black knot (*Plowrightia morbosa*, Sacc.), apple tree canker (*Nectria ditissima*, Sul.) and potato canker (*Chrysophlyctis endobiotica*, Schill.).

Brittain (W. H.). **The Green Apple Bug in Nova Scotia.**—*N.S. Dept. Agric., Truro*, Bull. no. 8, January 1917, 62 pp., 10 plates. [Received 20th March 1917.]

The Capsid bug, *Lygus communis* var. *novascotiensis*, Knight, has already been recorded in Nova Scotia under the name *Lygus invitus*, Say [see this *Review*, Ser. A, iv, pp. 96, 520]. The most satisfactory spray against it has been found to be nicotine sulphate (Blackleaf 40), $\frac{3}{4}$ pint to each 100 gals. water. Two applications are necessary ; the first should be made as soon as the blossoms show signs of opening and the second immediately after they have fallen. The control of this bug, being chiefly a mechanical problem, depends more upon the manner in which the spray is applied than upon any other factor. A strong, narrow, driving spray is essential in order to reach every part of the tree and every insect on it ; the best results were obtained in the experiments described by using a drive nozzle with a pressure of not less than 175 lbs. The amount of material necessary differs according to conditions, the average amount indicated being 12 gals. of liquid per tree for the first application and 16 gals. per tree for the second. The importance of pruning and thinning prior to spraying is insisted upon, and tanglefoot bands should be used to prevent the bugs which have fallen to the ground returning to the trees after spraying. The necessity for clean cultivation in order to destroy temporary host-plants round the base of the trees, and the dangers of scorching the foliage by heavy spraying, are emphasised. Lime-sulphur was found to be liable to injure foliage when used in the large quantities necessary, but the use of commercial lime-sulphur, 33° Bé. in the strength of 1-50 to 1-70, greatly reduced the danger from scorching. Where nicotine sulphate was employed in combination with soluble sulphur, no poison being included, there was no resultant injury to the foliage. Fish-oil carbolic mixture, used in combination with soluble sulphur and triplumbic arsenate of lead, caused considerable scorching, but little injury resulted where the arsenate of lead was omitted. The cost of treatment varies, but that of materials alone sufficient to control a severe infestation allowing for two sprayings amounted to about 1*s.* 4*d.* per tree. The use of spreaders such as flour paste or soap in the spraying mixture is advocated. A bibliography of 15 works is appended.

Afanassiev (A. P.). **Русское Виноградарство въ 1915 году. II-й вегетаціонный періодъ.** [Russian Viticulture in 1915. The second vegetative Period.]—**« Вѣстникъ Винодѣлія.»** [*Messenger of Viticulture*], *Odessa*, xxxv, nos. 5–6, 7–8 & 11–12, May-June, July-August and November-December 1916, pp. 237–246, 290–300 and 449–461.

This is the second series of reports on the state of viticulture in 1915, summarised on the lines of the previous ones [see this *Review*, Ser. A,

iii, p. 375]. Except for *Phylloxera*, insects were very scarce on the whole and were only occasionally reported. In Bessarabia *Clysia ambiguella* did more or less considerable damage in a few localities, this moth being reported also from the government of Cherson. Larvae of *Polyphylla fullo* and of a species of *Otiorrhynchus* were reported from Taurida; in addition to handpicking the last-named was controlled by spraying with 2–3% solution of barium chloride. *Eriophyes* (*Phytoptus*) sp. appeared in May in the province of Don; powdering with sulphur had little or no effect on this mite. *Polychrosis* (*Eudemis*) *botrana* and *Eriophyes* were controlled in Astrachan by spraying with arsenate of lead and Paris green. In the region of the Black Sea small numbers of *Otiorrhynchus turca* occurred, against which spraying with barium chloride was effected, while *Eriophyes* sp. was successfully controlled by removing and burning the infested leaves.

VASSILIEV (Eug.). **Борьба съ вредителями сельскаго хозяйства.** [The Control of Pests of Agriculture.]—**«Вѣстникъ Сахарной Промышленности.»** [*The Herald of the Sugar-Industry*], *Kiev*, no. 3, 28th January 1917, pp. 61–62.

It is stated that the Department of Agriculture has made arrangements with the Moscow People's Bank to purchase abroad, principally in England, through the London Agency of the above Bank, various insecticides, which may be required for the campaign against insect pests in the current year.

MERESHKOVSKY (S. S.). **Къ вопросу объ истребленіи саранчи культурами бацилла** d'Herelle'**а**. [On the Question of the Destruction of Locusts by means of Cultures of d'Herelle's Coccobacillus.]—**«Труды Сельскохозяйственно-бактеріологической Лабораторіи.»** [*The Transactions of the Agricultural-Bacteriological Laboratory*], vol. iv, no. 12, *Petrograd*, 1913, 2 pp. [Received 13th March 1917.]

This is a preliminary account of the conclusions arrived at from studies on *Coccobacillus acridiorum*. The cultures used were received by the author from the Pasteur Institute in Paris, from Argentina, and from the Pasteur Institute in Algiers, and he is of opinion that these represent distinct species of bacteria. From bacteriological observations on crickets, various micro-organisms are always to be found in different parts of the body, even in those not connected with the intestines. The uninterrupted passages from one individual to another as recommended by d'Herelle in order to increase the virulence of the virus, even should the blood of insects be used for this, do not exclude the possibility of a change in its identity. Owing to the variety of cultures in circulation, the author suggests that they should not be used in practice until it has been established that a genuine culture exists and that it possesses qualities pathogenic to *Locusta migratoria*.

Maltzev (M. V.). **Опыты выращиванія перелетной саранчи въ искусственныхъ условіяхъ.** [Experiments in breeding *Locusta migratoria*, L., under artificial Conditions.]—**«Труды Сельскохозяйственно-бактеріологической Лабораторіи.»** [*The Transactions of the Agricultural-Bacteriological Laboratory*], vol. v, no. 15, *Petrograd*, 1914, 25 pp., 19 figs. [Received 13th March 1917.]

Experiments on the artificial breeding of *Locusta migratoria*, L., in the Agricultural Bacteriological Laboratory of the Department of Agriculture are described. These lasted from November 1913 till December 1914, the original egg-clusters having been received from the Stavropol Entomological Bureau. The temperature conditions in the laboratory were approximately those under natural conditions. The egg-clusters, which proved to be quite free from parasites, were placed in earth in boxes, some of them in a horizontal and others in a vertical position; in some cases the eggs were separated from the spongy mass of the cluster. While the period of quiescence of the embryo in the egg does not influence the rate of development, the hatching of the larvae from the horizontal clusters took place more nearly simultaneously, being completed in 1 or 2 days, while in case of vertically placed clusters, this was spread over 5 to 7 days. Eggs separated from the clusters hatched at the normal time. In from 40 to 48 hours after hatching the larvae begin to feed and in the absence of other food devour each other. This was observed in all the larval stages, though cannibalism does not occur among the adults. The larvae were removed into breeding cages and fed on young seedlings of rye, oats and barley; in winter it was necessary to supplement this food with banana skins, which proved very attractive, and with hay containing a large amount of *Phleum pratense*, *Alopecurus pratensis* and *Poa pratensis*. Larvae fed on green food developed a fatal disease of the digestive organs, and the individuals which survived neither paired nor oviposited. A description of the process of moulting is given and a table showing the dates of moulting, pairing and oviposition. A further report is promised on the rearing of the next generation.

Pukhov (B. A.). **Мѣропріятія Оренбургскаго Земства по борьбѣ съ саранчевыми въ 1914 году.** [The Measures of the Zemstvo of the Government of Orenburg for the Campaign against Locusts in 1914.]—Published by the Orenburg Zemstvo, *Orenburg*, 1916, 27 pp. [Received 16th March 1917.]

This is a series of reports from different districts of the government edited by the author, who was in general charge of the campaign in 1914, in which year a special organisation against locusts was initiated by the Zemstvo. Chief attention was paid to the Tcheliabinsk district, where a large outbreak occurred in 1913 and was again threatening in 1914. The operations were conducted over some 8,500 acres. In the great majority of cases the egg-clusters were discovered during the preliminary investigations on or near arable land, so that danger threatened the crops from the first day of hatching; the steppes and meadows were infested only in some places. Only a small proportion of the egg-clusters were parasitised. The principal species present were:—*Gomphocerus sibiricus*, L., *Arcyptera flavicosta*,

F., *Podisma pedestris*, L., *Bryodema tuberculatum*, F. The insecticides used were Paris green (3-4 lb. in 70-75 gallons of water); sodium arsenite ($1\frac{1}{2}$-2 lb. in 70-75 gallons of water) and zinc oxide ($1\frac{1}{2}$-2 lb. in 70-75 gallons of water). The total cost of the campaign exceeded £2,100, including capital expenses on sprayers and some other appliances, which reduced the cost of the actual work to some £1,700, or to about 4*s.* per acre.

Pukhov (B. A.). **Мѣропріятія Оренбургскаго Губернскаго Земства по борьбѣ съ саранчевыми въ 1915 г. и проектъ мѣропріятія на 1916 г.** [The Measures of the Zemstvo of the Government of Orenburg for the Control of Locusts in 1915 and the Plan of Measures for 1916.]—Published by the Orenburg Zemstvo, *Orenburg*, 1916, 100 pp. [Received 16th March 1917.]

A sum amounting approximately to £6,000 was assigned by the Zemstvo of the Government for the campaign against locusts in 1915. In the autumn of 1914, over 11,000 acres were found to be infested with egg-clusters, while the average percentage of those infested with parasites did not exceed $7\frac{1}{2}$ per cent. The hatching of the eggs began in the second half of May, when the operations were also started. The population was this year more ready to assist, having largely changed its attitude owing to the lessons and results of the operations of the previous year, but delays arising from the non-delivery of various materials and other reasons, chiefly connected with the War, resulted in serious damage to some 3,500 acres of crops. Better results were obtained in localities where the egg-clusters were situated in the steppes. The insecticide used in 1915 was sodium arsenite, $1\frac{1}{2}$ lb. to 70–75 gallons of water, this being sufficient to avoid scorching the plants. The cost amounted to about 4*s.* per acre and the results were regarded as satisfactory. Experiments with poisoned baits carried out during the preceding year had given encouraging results, and in 1915 this method was applied over an area of about 180 acres. The baits were prepared from bran, molasses, arsenic and water, the proportion sufficient for 2·7 acres being: 40 lb. of bran, 16 lb. of molasses, 2 lb. of arsenic and 4 or $4\frac{1}{2}$ gallons of water.

It is thought possible that the same results might be obtained by using less arsenic and molasses, thus reducing the cost of the preparation. Three men with a one-horse cart were able to cover in 10 hours from 27 to 30 acres, the cost of both wages and materials for the baits amounting to 1*s.* 8*d.* per acre. The percentage of egg-clusters infested with parasites or fungus diseases was $11\frac{1}{2}$. Larvae of *Mylabris* were found almost exclusively in those of *Arcyptera flavicosta*, F., while fungi were observed chiefly in those of *Gomphocerus sibiricus*, L.

A short report by G. M. Vinokurov is appended dealing with the work in the Tcheliabinsk district. The species of locusts present occurred in the following proportions:—*G. sibiricus*, 80%; *A. flavicosta*, prevalent in meadows, 10%; *Podisma pedestris*, L., chiefly in areas overgrown with weeds, 5%; *Oedipoda coerulescens*, L., and other species, 5%. In some localities as many as 100% of the egg-clusters were infested with *Mylabris*, principally those of *A. flavicosta.* About 5% of those of *G. sibiricus* were infested with Bombyliid flies of the genus *Anastoechus* (*Systoechus*), while no *Mylabris* were found in over 1,000

clusters of this species. Larvae of *Mylabris* were also reared from egg-clusters of *P. pedestris*. Other parasites were mites and worms of the genus *Mermis*. Mites, however, are not regarded as seriously harmful to locusts, while the worms were not numerous enough to be of practical importance. Fungus diseases were also present, and other locust enemies included hedgehogs, quails, starlings, sparrows and other birds.

PUKHOV (B. A.). **Мѣропріятія Оренбургскаго Губернскаго Земства по борьбѣ съ вредителями сельскаго хозяйства въ 1916 г. и проектъ мѣропріятія на 1917 г.** [The Measures of the Zemstvo of the Government of Orenburg for the Control of Pests of Agriculture in 1916 and the Plan of the Measures for 1917.] —Published by the Orenburg Zemstvo, *Orenburg*, 1917, 53 pp.

In 1916 a sum of about £2,400 was assigned by the Zemstvo for the locust campaign, more than half of which was again destined for the Tcheliabinsk district, where about 6,700 acres proved to be infested with egg-clusters. The hatching of the locusts was delayed by the cold weather prevailing in May and began on a large scale only on the 23rd of that month. Towards the second half of June, all the threatened crops were effectively protected, but the great drought which set in at that time caused the locusts remaining on the steppes to invade the crops again and it became necessary to renew the campaign, this time mostly by means of poisoned baits. The results of this method, which was used on some 3,000 acres, showed conclusively that it must be regarded as thoroughly effective and in many cases preferable to spraying, being less expensive and less dependent for its results on meteorological conditions. The final cost of the operations amounted to rather less than 2*s.* 6*d.* per acre. The investigations carried out in autumn showed that notwithstanding the favourable weather conditions for the breeding of these pests in 1916, only some 3,200 acres were infested with egg-clusters. At the same time the percentage of clusters attacked by parasites increased to 13·8 per cent., compared with 11 per cent. in 1915, and 7·5 per cent. in 1914.

Observations were also made on *Phlyctaenodes sticticalis*, L., which was injurious in several localities, and *Lymantria dispar*, which is a serious pests of forests in this district.

A memorandum presented to the Zemstvo as to the campaign against locusts in 1917 is appended, in which the cost of the operations is estimated at about £1,500.

KSENJOPOLSKY (A. V.). **Обзоръ вредителей Волыни и отчетъ о дѣятельности Волынскаго Энтомологическаго Бюро за 1915 годъ.** [Review of the Pests of Volhynia and Report of the Work of Volhynian Entomological Bureau for 1915.]—Published by the Zemstvo of Volhynia, *Jitomir*, 1916, 24 pp.

The proximity of the theatre of the War has interfered with the normal work of the Bureau and is responsible for the limited information contained in this report.

Chief amongst the pests of orchards was *Anthonomus pomorum*, L., which appeared at the end of April and destroyed over half of the apple blossoms and many pears. Of some 600 buds containing larvae

and pupae of this weevil collected at the end of May, only 13 parasites were reared, belonging to two species of Icheumonids and one Chalcid. According to several years observations, paradise apples are very little attacked by this pest. *Hyponomeuta mallinellus*, Z., was on the wing during June and was parasitised by two Ichneumonids and a Tachinid. An exceptional case of injury to pear-trees by caterpillars of *Vanessa polychloros* resulting in total defoliation is recorded. *Aporia crataegi* was scarce, being parasitised by *Apanteles* (*Microgaster*) *glomeratus*, L. Caterpillars of *Eucosma* (*Tmetocera*) *ocellana*, Schiff., appeared on apple trees, in some cases in company with *Argyroploce* (*Grapholitha*) *variegana*, Hb. Other new pests were *Coleophora hemerobiella*, Scop., and *C. nigricella*, Steph., two species of Ichneumonids and one Chalcid being reared from the latter. Other pests of orchards included: *Psylla mali*, Forst., and *Melolontha melontha*, L., a large outbreak of which occurred in one nursery, where about 78,000 adults were destroyed by handpicking. *Psylliodes attenuatus*, Koch, and *Phorodon humuli*, Schr., injured hops.

The chief pests of market-gardens were *Gryllotalpa gryllotalpa*, L., *Hylemyia antiqua*, Mg., and *Pieris brassicae*, L. Beetroots suffered from flea-beetles and *Otiorrhynchus ligustici*, L., which replaces in Volhynia *Bothynoderes* (*Cleonus*) *punctiventris*, Germ., which is prevalent in Kiev. Clover was attacked by *Apion assimile*, Kirby, and *A. trifolii*, L., the latter being less numerous.

Pests of cereals included:—*Bruchus* (*Laria*) *pisorum*, L., *Feltia* (*Agrotis*) *exclamationis*, L.; *Apamea* (*Hydroecia*) *nictitans*, Bkh.; *Hadena basilinea*, F.; *Barathra* (*Mamestra*) *brassicae*, L.; *Polia* (*M.*) *persicariae*, L.; *P.* (*M.*) *pisi*, L.; *P.* (*M.*) *oleracea*, L.

Forests were injured by *Acronycta rumicis*, L., *Episema* (*Diloba*) *coeruleocephala*, L., *Lymantria monacha*, L., *Panolis flammea*, Schiff. (*piniperda*, Panz.), *Dendrolimus pini*, L., and *Hibernia defoliaria*, Cl.

A list of enemies of bees includes:—*Epeira diadema*, L., *Acherontia atropos*, L., *Galleria mellonella*, L., *Meloë violaceus*, Mar., *M. proscarabeus*, L., *Trichodes apiarius*, L., *Bombus terrestris*, L., *Vespa crabro*, L., *V. vulgaris*, L., ants of the genera *Formica*, *Lasius*, and others, *Forficula auricularia*, L., *Braula coeca*, Nitzsch, and some mites. Bees also suffer from a disease caused by *Bacillus alveolaris*. The most important of these pests is *G. mellonella*, of which two generations occur.

A short report of the work of the staff of the Bureau is appended, and mention is also made of a project by the local Zemstvo for enlarging the existing Bureau and instituting a Station, with Entomological and Phytopathological Sections, the total cost of which, including a new building, is estimated to amount to about £4,000.

DUBNIAKOV (K.). **Объ амбарныхъ вредителяхъ.** [On Pests of Stored Grain.]—**«Хозяйство на Дону.»** [*Husbandry on the Don*], *Novotcherkassk*, xi, no. 14, 7th August 1916, pp. 627–630. [Received 16th March 1917.]

Calandra granaria, L., has recently become very numerous in the Province of Don and the resulting damage has been especially serious in the last few years, when large quantities of grain and other

food-stuffs have been kept in the warehouse for the requirements of the Army. In giving a short account of the life-history of this weevil, the author refers to the resolutions passed by the conference at Kiev [see this *Review*, Ser. A, iv, p. 106].

MAKAROV (T.). **Объ амбарныхъ вредителяхъ.** [On Pests of Stored Grain.] **«Хозяйство на Дону.»** [*Husbandry on the Don*], *Novotcherkassk*, xi, no. 14, 7th August 1916, pp. 630–633. [Received 16th March 1917.]

Tenebrio molitor made its appearance in the spring of 1915 in some storehouses of the Province. Both the larva and adults are injurious, and, in contradistinction to *Calandra granaria*, which feeds inside the grains, this species gnaws them from the outside; it also attacks flour. Smearing the walls of storehouses with carbolic oil has proved an effective remedy. Other remedies are tar and naphthaline.

SILANTIEV (A. A.). **Какъ организовать въ Россіи охрану полезныхъ для сельскаго хозяйства животныхъ.** [How to organise in Russia the Protection of Animals useful in Agriculture.]—**«Сельское Хозяйство и Лѣсоводство.»** [*Agriculture and Forestry*], *Petrograd*, cclii, no. 9–10, September-October 1916, pp. 75–93. [Received 16th March 1917.]

In this paper the author proposes a scheme for the protection of birds and other animals useful in agriculture, which should be carried into effect by the combined efforts of the Ministries of Agriculture and Education. The former authority should establish a central station for studying the noxious and beneficial species and for devising measures to protect the latter. This station should also supervise the work carried on on similar lines by its local branches, established in various parts of the country, preferably in conjunction with the Agricultural Experimental Stations. The Ministry of Education should assist in spreading a knowledge of useful animals by organising lectures, by issuing popular publications and by supplying the existing museums with exhibits bearing on the subject.

ARTYNOV (O. N.). **Подъ угрозой филлоксеры.** [Under the Menace of *Phylloxera*.]—**«Хозяйство на Дону.»** [*Husbandry on the Don*], *Novotcherkassk*, xi, no. 19, 25th October 1916, pp. 874–882.

The Don Provincial Committee of Viticulture is undertaking an examination of the vineyards of several localities in the Province, from which reports have come as to the presence of *Phylloxera*. Although this pest was discovered in one vineyard in 1911, having been imported with some seedlings, it was at once suppressed, and up till now the Province has been considered free from it, as a thorough examination carried out in 1913–14 did not reveal its presence. A short history of the spread of *Phylloxera* in Europe and Russia and an account of its life-history and methods of control are given, in order to put the public on their guard in case the examination of the vineyards should confirm its presence.

Makarov (T.). **Характеръ поврежденій озимей озимымъ червемъ и мѣры борьбы съ нимъ.** [The Nature of the Injuries to winter-sown Crops by Caterpillars of *Euxoa segetum* and the Methods of their Control.]—**«Хозяйство на Дону.»** [*Husbandry on the Don*], *Novotcherkassk,* xi, no. 23, 28th December 1916, pp. 1070–1080.

Caterpillars of *Euxoa segetum* have appeared of late years in many parts of the Province of Don, gradually increasing in numbers and spreading over new and large areas. The author carried out observations on this pest on some experimental fields in one district both in 1914, when reploughing the infested areas gave satisfactory results, and again in 1915. The results of these observations are summarised as follows :—Rye is injured to a greater degree than winter wheat; crops grown on occupied fallow lands [see this *Review*, Ser. A, ii, p. 316] are far less injured than those grown on black or clean fallow; early sown crops are more injured than later ones; crops sown on late ploughed fallows are more injured than on early ploughed ones. The most effective remedy is to plant early trap-crops, preferably of rye in strips, separated from the rest of the field by trenches, these strips being subsequently sprayed with Paris green (2–4 lb. of green, 4–8 lb. of freshly slaked lime in about 110–120 gallons of water).

Uvarov (B.). **Собраніе дѣятелей по прикладной энтомологіи въ Кіевѣ.** [The Meeting of Workers in Applied Entomology in Kiev.]—**« Земледѣльческая Газета.»** [*Agricultural Gazette*], *Petrograd,* no. 49 (165), 16th December 1916, pp. 1252–1254. [Received 16th March 1917.)

This paper reviews the proceedings of the first annual meeting of the Russian Society of Workers in Applied Entomology, which took place in Kiev on 3rd–9th November 1916. The meeting was attended by representatives of the great majority of Russian entomological organisations. The papers read included those by Professors N. M. Kulagin and A. A. Silantiev on the organisation of a Central Entomological Bureau. This question was further considered by a Committee consisting of S. A. Mokrzecki, V. G. Averin, B. P. Uvarov and V. V. Dobrovliansky, and it was decided that a Central Bureau should be established in Petrograd, at the Department of Agriculture, and that its object should be to co-ordinate the work of the local Bureaus and also to supervise the execution of works of Imperial importance. This would include :—the preparation of a scheme for providing for the establishment of local entomological bureaus and assisting them in identifying insects, procuring the necessary apparatus, etc., and examining sprayers and insecticides; the drawing up of legislation for the control of pests in Russia and advising the Government as to money-grants in this connection; the publication of entomological literature and the training of a staff of experts. The Bureau should be in charge of a Committee, consisting of representatives of the Departments of Agriculture and Forestry, the Institute of Experimental Agronomy, the All-Russian Agricultural Chamber, the Russian Society of Workers in Applied Entomology, the local Entomological Bureaus and the chairs in Applied Zoology and Entomology at the Russian Universities. In order to provide for a sufficient staff of expert entomologists, the

meeting recommended the organisation of one-year courses on entomology and the provision of special training for the students of the last two years of the Agricultural High-Schools and Universities, which should include practical work at a local bureau.

The meeting also discussed the urgent question of the infestation by insects of stored grain, about 10 papers being read on this subject.

A paper by I. V. Emelianov dealt with the existing entomological organisations, of which there are 220 in the whole world, 74 being in Great Britain and its Colonies, 68 in the United States and 51 in Russia, Germany having only 7, while China, Turkey, Portugal and Brazil have none.

Grimshaw (P. H.). **A Guide to the Literature of British Diptera.**—Separate, dated 12th March 1917, from *Proc. Royal Phys. Soc. Edinburgh, Edinburgh*, xx, part 2, pp. 78–117.

This bibliography contains references to various species of economic importance, special notice being given to flies injurious to vegetation such as the Cecidomyidae.

Imms (A. D.). **Tarred Felt Discs for protecting Cabbages and Related Vegetables from Attacks of the Root-fly.**—*Jl. Bd. Agric., London*, xxiii, no. 12, March 1917, pp. 1222–1224, 3 figs.

The information given in this article concerning the control of *Chortophila brassicae* has already been abstracted from another source, [see this *Review*, Ser. A, v, p. 171].

Arrangements have been made for the discs to be manufactured, and the address of the maker may be obtained on application to the Secretary, Board of Agriculture and Fisheries, Whitehall Place, London, S.W.

Insect Pests and their Control in Canada.—*Canadian Horticulturist and Beekeeper, Toronto*, xxv, no. 2, February 1917, pp. 25–64.

This number contains a series of popular articles, including notes on various sprays for fruit trees and the best times for their use, by D. Johnson; results of experiments to determine the relative merits of dusting and liquid spraying, by L. Caesar (no conclusive result on this point having been arrived at); the economic advantages of spraying, by M. Ells. Brief accounts are given of cherry fruit-flies and their control, by L. Carson; pear psylla, by L. Caesar; Aphids injurious to apple trees, by W. A. Ross; and the war on orchard pests during 1916, by W. E. Biggar. There are also several papers on beekeeping.

Cameron (A. E.) & Treherne (R. C.). **Work of combating the Pear Thrips in the Saanich Peninsula.**—*Agric. Jl., Victoria, B.C.*, i, no. 12, February 1917, p. 208.

Observations show that the attacks of pear thrips [*Taeniothrips inconsequens*] can be prevented on apples better than on pears. Italian prunes and plums are also liable to be severely attacked. It has been found that absolute control on apples can be achieved, but the results on pears and prunes are not satisfactory. The following mixture was used extensively:—Whale-oil soap, 5 lb.; Black Leaf 40, $\frac{3}{4}$ pint; water, 85 gals.

Miscible oil No. 2 was also tested. The oil appeared to be more effective in penetrating the opening buds early in the spring and reaching the thrips feeding in them. The results of spraying showed that fully 50% of the adults were killed after each spraying either with soap or oil mixtures, whilst the larval mortality in some cases reached as high as 77%. Arsenate of lead in the proportion of 2 lb. to 40 gals. of mixture was added to the second and third applications. The cost per tree varied from 7*d.* to 1*s.* 5*d.* for three applications. The amount of mixture applied per tree varied from 1½ to 5 gallons according to the size and age of the tree. Owing to the prevalence of apple-scab, it is advised that this year a combination spray of summer-strength lime-sulphur and Black Leaf 40 in the proportion of 1 to 900 will be most efficacious for the second and third applications for apples and pears. As a first application for apples, pears and cherries the whale-oil soap and Black Leaf 40 combination spray is advised. The first application should be made when the thrips make their appearance, the second as the blossoms are showing colour, and the third just after they are shed.

Rhumann (M. H.). **The Woolly Aphis of the Apple is becoming a serious Pest.**—*Agric. Jl., Victoria, B.C.*, i, no. 12, February 1917, p. 209, 1 fig.

The woolly aphis (*Eriosoma lanigerum*) has become a common and serious pest in British Columbia during the last six years. Sprays should be applied directly the insects appear, sufficient force being used to remove their loose waxy coverings and expose the surface of their bodies to the spray liquid. When root-infestation is present, the main roots within a radius of two feet of the trunk should be exposed and drenched with the spray, as also should the soil before it is replaced. To prevent the migration of this Aphid to the roots, a small quantity of the surface soil near the base of the trees may be removed and replaced with fine sand.

The following formulae are given for control mixtures :—As a contact spray, nicotine sulphate 40%, 1½ pints; cresol soap, 1 gal., or whale-oil soap 12 lb. ; water, 200 gals. For dipping infested nursery stock before replanting, nicotine sulphate 40%, 1½ fluid ounces; cresol soap, 5 fluid ounces, or whale-oil soap, 6 ounces ; water, 5 gals.

Winslow (R. M.). **Fruit-growers realise that increased Spraying is necessary.**—*Agric. Jl., Victoria, B.C.*, i, no. 12, February 1917, p. 218.

An increase has occurred in the number of power sprayers in use in various districts of the Province. The result of experimental work shows that nicotine sulphate and a whale-oil soap spray will control pear thrips [*Taeniothrips inconsequens*]. Against Aphids a mixture of Black Leaf 40, 6 oz., lime 2 lb., and 100 gals. of water destroys practically all the insects.

Shinji (G. O.). **The Californian Species of *Myzus*, with the Description of a New Species.**—*Canadian Entomologist, London, Ont.*, xlix, no. 2, February 1917, pp. 49–51, 1 fig.

The following species were collected in Berkeley, California, during 1915 :—*Myzus cerasi*, F., from cultivated cherry (*Prunus cerasus*);

M. circumflexum, Buckt., from numerous garden plants, including pansy, *Fuchsia* sp., wallflower, lilies, iris, gladiolus, etc.; *M. rosarum*, Walk., from wild and cultivated roses; *M. rhamni*, Boy., from California coffee-berry tree (*Rhamnus californica*) and *Cascara sagrada*; *M. ribis*, L., from wild gooseberry; and a new species, to be described by Prof. Essig, from *Aquilegia vulgaris* and *A. truncata*. A description is given of *M. godetiae*, sp. n., from *Godetia amoena*.

SHINJI (G. O.). **A New Species of *Amphrophora* from California.**—*Canadian Entomologist, London, Ont.*, xlix, no. 2, February 1917, pp. 51–52, 1 fig.

A description is given of *Amphrophora cicutae*, sp. n., found on *Cicuta virosa* var. *californica*.

WEISS (H. B.). **The Bay Flea-louse, *Trioza alacris*, Flor, as a new Pest in New Jersey.**—*Canadian Entomologist, London, Ont.* xlix, no. 2, February 1917, pp. 73–75.

The Psyllid, *Trioza alacris*, has only recently become sufficiently numerous in New Jersey to disfigure its host, *Laurus nobilis*, at all seriously. It has probably been introduced from Belgium on imported stock and may occur in other parts of the country. Its presence can easily be detected by the curled, discoloured leaves, usually at the tips of the branches, containing what appear to be cottony masses. For control measures, when the infestation is slight or the number of affected trees is small, the infested leaves may be picked off and destroyed. In more severe cases a spray composed of 8 oz. Black Leaf 40 with 8 lb. whale-oil soap in 100 gals. [?U.S.] of water has been used with fair success in New Jersey. Fumigation with hydrocyanic acid gas (the American 1–1–3 formula being used) has also been reported as successful.

CROSBY (C. R.) & LEONARD (M. D.). **The Farm Bureau as an Agency for demonstrating the Control of Injurious Insects.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 1, February 1917, pp. 20–25.

The authors strongly advocate the holding of local demonstrations for the dissemination of knowledge relating to insect pests. By this means the farmers can be convinced of the practicability and profit of the practices recommended, and demonstrations can be conducted in any community where conditions render them desirable. The subjects for such demonstrations should be chosen and conducted in such a way as to help the grower to fight the insect enemies of his crops in a practical manner and under the conditions actually existing on his farm. The problems to be solved are problems of applied entomology and can only be worked out by expert entomologists, upon whom rests the responsibility of initiating and guiding this work along entomological lines.

Headlee (T. J.). **Some facts relative to the Influence of Atmospheric Humidity on Insect Metabolism.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 1, February 1917, pp. 31–38.

The effect of atmospheric moisture upon the rate of insect metabolism has been proved to be extremely variable, in some cases retarding development and in others hastening it. In experiments undertaken with the bean weevil, *Bruchus obtectus*, Say, a study was made of the variations in the rate of metabolism in response to atmospheric humidity in the different stages of a single species entirely dependent upon metabolic water, and of the underlying cause of the response. In order that such factors as temperature and light or the presence of carbon dioxide and oxygen might not influence the results, an effort was made to eliminate them as variables, all insects being kept at a temperature of 80° F., in complete darkness, subjected to a passing stream of air, and the experiments were carried on simultaneously with a view to eliminating as far as possible the variable barometric pressure. The experiments are described in detail and tables of the results given. The conclusions reached were that the rate of metabolism in the pupae of both the bean weevil and the Angoumois grain moth, *Sitotroga cerealella*, Oliv., varies inversely with atmospheric humidity; in the adult of the former it varies with, while in the adult of the latter it varies inversely as the humidity; in the egg-stage the speed of metabolism varies inversely with the humidity; in the larvae it varies with the humidity; in the life-cycle as a whole the rate varies with the humidity.

Among insects dependent upon metabolic water alone, this response to atmospheric moisture leads to the supposition that for each stage of the insect there is a definite internal water optimum, that is, an amount of body fluid which will permit necessary chemical and physical changes to take place with the greatest ease and speed. Atmospheric humidity apparently acts upon the insect by the removal of water and also by the prevention of the loss of body fluid. The relation of the supply of body fluid to the optimum in any specific stage of an insect is therefore the underlying cause of the effect of atmospheric moisture. Continued exposure to dry air will reduce the body fluid until the tissues become so poorly supplied that living processes can no longer continue, and death follows. This is well shown in the destruction of the bean weevil larvae and the pupal stages of the Hessian fly [*Mayetiola destructor*] by drought.

The inability of the bean weevil to reproduce in moisture of 26 per cent. or below led to an examination of dry air as a means of sterilising and preserving bean seeds from weevil injury. Experiments showed that in a sealed chamber about 5 cc. of concentrated sulphuric acid per 1,000 cc. of air prevents reproduction when a limited number of beans is used. This amount has to be increased in proportion to the moisture which the beans can give off. Germination tests showed that a prolonged exposure of 92 days resulted in injury to the beans. The period required for sterilisation does not however exceed 30 days and this would not affect the vitality at all. The native Rhodesian method of protecting maize from weevils by mixing the grain with finely powered wood ashes is probably a practical application of the effect of low relative humidity.

Hadley (C. H. Jr.) & Matheson (R.). **The Seventeen-year Locust in Western New York.**—*Jl. of Econ. Entom., Concord, N.H.*, x, no. 1, February 1917, pp. 38–40.

Tibicen septendecim, the periodical cicada or seventeen-year locust, was reported as appearing in varying numbers in several countries in western New York during the summer of 1916. This insect last appeared in New York in 1899. In an area of old apple orchards a spraying test was carried out with Bordeaux mixture to which was added a large amount of lime, 60 to 80 lb. to 100 U.S. gals. of the mixture, but this spray did not apparently deter the insects from ovipositing.

Davis (J. J.). **A Chemical Feeding Analysis of White Grubs and May-beetles** (*Lachnosterna*) **and its Economic Application.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 1, February 1917, pp. 41–44.

The value and utilisation of pigs for the destruction of soil-inhabiting pests, such as white grubs and cutworms, is discussed in this paper. The destruction is reported of 99 per cent. of grubs in a badly-infested 10-acre maize field after pasturing for 27 days with 108 pigs. In order to convince farmers of the value of this practice, a chemical analysis of the grubs and May-beetles was made, the results of which are given, and compared with a feed of maize. The fat and protein contents of the grubs compare favourably with these constituents in maize, but the carbo-hydrates are deficient, indicating the advantage of feeding maize in connection with the grubs, or pasturing pigs in grub-infested land bearing a crop of maize. Analysis shows that the value of the grubs as food and the value of the manure produced by such feeding is well worth the expense of fencing a field with wire which will contain pigs. The injury to an infested pasture by the rooting of pigs is found to be negligible. A more serious danger is the possible infection of the pigs with the tape-worm, *Echinorhynchus gigas*, of which the white grub is an intermediate host [see this *Review*, Ser. A, ii, p. 122]. As a precaution, pigs that have never been pastured should be used in fields which have not been previously so dealt with within three years.

Merrill (J. H.). **Further Data on the Relation between Aphids and Fire Blight** (*Bacillus amylovorus*, **Bur. Trev.**).—*Jl. Econ. Entom. Concord., N.H.*, x, no. 1, February 1917, pp. 45–46.

The report of field observations made in the years 1915 and 1916 showed that a direct relation existed between the severity of Aphid infestation and the amount of fire-blight infection. During the spring and summer of 1916, experiments were conducted to determine how it was possible for the Aphids to come in contact with the blight bacteria, and whether or not they could inoculate trees with fire-blight. The examination of cankers showed that Aphids deposited their eggs in them as readily as in any rough places in the bark. In the spring the Aphids which hatch from these eggs crawl through the gummy exudations of the then active cankers and become comtaminated with blight bacteria, which they carry to the terminal growths of the twigs. For the inoculation experiments, Aphids were passed over pure cultures of blight bacteria and then transferred to the twigs of apple trees.

The results showed that blight developed only in the tender, succulent growth on the twigs, and that Aphids can and do inoculate trees with the bacteria of fire-blight.

Lowry (Q. S.). **An Outbreak of the Eight-spotted Forester,** *Alypia octomaculata*, **F., in New Haven, Conn.**—*Jl. Econ. Entom., Concord. N.H.*, x, no. 1, February 1917, pp. 47–48.

In July 1916 the caterpillars of the Agaristid, *Alypia octomaculata*, were found in thousands defoliating grape-vines and Virginia creeper within a radius of about a mile. This moth is rarely found except in city gardens, but it is evident from the outbreak in New Haven that considerable damage and financial loss would result if it became abundant in commercial vineyards. It also feeds on the common barberry, *Berberis vulgaris*, and roses. From larvae collected in July, two Tachinid parasites emerged and were identified as *Winthemia quadripustulata*, F. It remains to be seen whether this pest will occur in the same locality another year and whether the parasite will keep it in check.

Becker (G. G.). **Notes on the Peach-tree Borer** (*Sanninoidea exitiosa*). —*Jl. Econ. Entom., Concord, N.H.*, x, no. 1, February 1917, pp. 49–59.

These notes deal with the pupal and adult stages of *Aegeria exitiosa*. Records are also given of observations on the stages of emergence of the adults. The period from the time when the larva spins the cocoon until the moth emerges, ranges from 18 to 30 days, darkness having the effect of retarding the process. A chart is given illustrating the emergence of the insect during the period June to October in the years 1910, 1912 and 1913, the dates of maximum emergence lying between the 27th August and the 8th September. Males and females were found to occur in about equal numbers. About 50 per cent. of the eggs were deposited at the base of the peach tree, 34 per cent. a little higher up, the rest on leaves, twigs, etc. The difficulties in the way of mechanical control by tree protectors are therefore obvious.

Felt (E. P.). **"Side Injury" and Codling Moth Control.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 1, February 1917, pp. 60–63.

Side injury is produced by late-hatching larvae of the codling moth [*Cydia pomonella*] entering the smooth side of the apple, forming a circular gallery just under the skin, and then abandoning this attack and migrating usually to the blossom end of the fruit. Investigation shows that there is a fairly constant ratio between the total of infested fruit and the apples showing side injury. The development of side injury is apparently dependent upon the deposition of eggs when the apples have grown to an inch or so in diameter. Experiment shows that the spraying just after blossoming is the best control for this, but further data are necessary before an effective remedy is found.

In the course of the discussion following this paper, Mr. Siegler gave some further particulars of the codling moth trap which has already been described [see this *Review*, Ser. A, v, p. 113]. Experiments show that this trap apparently attracts as many larvae as the ordinary cloth band, while its advantage over this method is obvious.

Becker (G. G.). **The Control of the Round-headed Apple Tree Borer.** —*Jl. Econ. Entom., Concord, N.H.,* x, no. 1, February 1917, pp. 66–71.

Experiments in control of this borer [*Saperda candida*] have led to the conclusion that white lead is impracticable for this purpose, as trees have to be treated again each year, while the protection obtained is not commensurate with the cost. Paper wrappers and tree veneers may be dangerous, as they harbour other insect pests, while their renewal and readjustment each year may render their use too costly. The cost of screening is also prohibitive, while the danger from girdling is a factor against its use. Asphaltum has been found to injure the tree to such an extent as to render its use too risky. The most practicable and the cheapest method of controlling this borer has proved to be the destruction of the individual larvae in the trees during August and early September.

Metcalf (Z. P.). **Lime as an Insecticide.** —*Jl. Econ. Entom., Concord, N.H.,* x, no. 1, February 1917, pp. 74–78. 2 plates.

In experiments for the control of *Bruchus chinensis*, L., and *B. quadrimaculatus*, F., (cow-pea weevils), in peas stored for seed, fumigation with carbon bisulphide was found to have no influence on the breeding of the weevils. Kerosene, crude carbolic acid and air-slaked lime were then tried, the last-named giving decidedly the best results. A series of experiments was then carried out in which peas were treated with varying proportions of air-slaked lime, ranging from 4 parts lime to 1 part peas to 1 part lime to 11 parts peas. A table is given detailing the results of these experiments. Taking into consideration the results of germination tests and also the proportion of emergence holes in the treated peas, the conclusion reached is that peas should be stored in air-slaked lime at the rate of one part lime to two parts peas by weight, though it is hoped that a cheaper and simpler method may be devised.

Parrott (P. J.). **The Radish Maggot and Screening.**—*Jl. Econ. Entom., Concord, N.H.,* x, no. 1, February 1917, pp. 79–81.

Experiments on growing radishes under cheese-cloth as a protection from root maggots and flea-beetles are described. As soon as planting is completed, the frames are placed in position and the cheesecloth attached, the plants being thinned and weeded when the first pair of true leaves appear. A table giving the results of these experiments demonstrates that plants thus screened show a larger proportion of marketable roots.

Hewitt (C. G.). **Insect Behaviour as a Factor in Applied Entomology.** —*Jl. Econ. Entom., Concord, N.H.,* x, no. 1, February 1917, pp. 81–94.

Insect behaviour constitutes the basis of applied entomology—a fact which cannot be too generally realised nor too constantly borne in mind. Early investigations by entomologists were limited to the study of the life-histories of insects, control measures being based on this knowledge, supplemented by a limited study of the insects' habits.

It was impossible to account for the outbreaks of certain insects or to discover effective means of control until a study was made of the reactions of insects to their environment, to each other and to the different biological constituents of their environment. For example, it was not until Forbes worked out the relation of *Aphis maidiradicis* (the corn root-aphis) to the ant *Lasius niger americanus*, on which it depends for its well-being, that any success in controlling this serious maize pest could be attained. Such control measures as the breaking up of the ant colonies in the spring, and the destruction of weeds on which the ants establish the wingless Aphids before the growth of the maize, are based solely on a knowledge of behaviour.

The chief tropisms or reactions of insects to environmental influences are considered in detail. The importance of chemotropism in feeding and reproduction is evinced by the females of *Pieris rapae* and *P. brassicae*, which select the leaves of cruciferous plants on which to oviposit, being attracted by the mustard oils present in them. The larvae of the sawfly, *Priophorus padi*, which feed on the foliage of rosaceous plants, are probably attracted by the glucoside, amygdaline. The chemotropic reactions on the part of carrion beetles, and to excrement on the part of coprophagous Coleoptera and Diptera are well known. Flies of the genus *Sarcophaga* have been induced to oviposit in a bottle containing scatol, a decomposition product of albuminous substances, and the oviposition response in *Stomoxys calcitrans* has been stimulated by means of valerianic acid. House-flies have been induced to oviposit apparently in response to an attraction of ammonia in conjunction with butyric and valerianic acid. The positive reaction of *Drosophila* to fermenting fruit is largely due to amyl, especially ethyl alcohol, acetic and lactic acid and acetic ether.

In studying the different behaviour of the same species of insect to different plants, it is found that a chemotropic reaction is sometimes responsible for the creation of a biologically distinct race of the same species. A form of *Rhagoletis pomonella* infesting *Vaccinium* (blueberries) and *Gaylussacia baccata* (huckleberries) is below the normal size, and appears to be long-established, while the larger apple-bred race refuses to oviposit on blueberry and *vice versa*.

A further example of chemotropic reaction, which promises results of great practical value, is the study of the resistance of plants to insect attack, with a view to the production of insect-resisting varieties in crops subject to injury, as a preventive measure against insect pests.

Other tropisms dealt with are thermotropism, temperature being a far-reaching and universal influence on insect behaviour and a potent factor in determining the range of insect activity. It is inseparably allied with hydrotropism, especially in the effects of climate on insect distribution and migration. Phototropism will undoubtedly place a valuable weapon in the hand of the applied entomologist, and has already been used to advantage, as in the case of the larvae of *Monochamus* (*Monohammus*), which can be prevented from destroying piled logs when these are thickly shaded. Anemotropism has a large influence in the distribution of insects. The Rocky Mountain locust [*Melanoplus spretus*] moves with the wind and when the air current is feeble is headed away from the source. The brown-tail moth [*Euproctis chrysorrhoea*] in New England and Eastern Canada is largely distributed by wind, while the first stage larvae of the gipsy moth [*Lymantria dispar*]

in New England are probably carried by the wind in a north and north-easterly direction and thus distributed.

The most notable example in applied entomology of the practical value of a knowledge of instinctive behaviour is seen in beekeeping. It is through such understanding of the relations and reactions of insects to the physical and biological factors in their varied environments that applied entomologists will be enabled to solve some of the greatest problems that have to be faced both now and in the future.

In the discussion following the President's address, Mr. A. D. Hopkins remarked that the mountain pine beetle, *Dendroctonus monticolae*, will destroy mountain pine, yellow pine, lodgepole pine and sugar pine, but if it becomes established in one species of pine through many generations, the beetles on emergence show a decided preference for the species on which they have bred, and will not, in fact, attack any other.

COOLEY (R. A.). **The Spinach Carrion Beetle,** *Silpha bituberosa*, **Lec.** —*Jl. Econ. Entom., Concord, N.H.*, x, no. 1, February 1917, pp. 94–102, 1 plate.

This species is native to North America and while abundant and injurious in the Northern States is very seldom recorded in the South. Sugar-beet and spinach are favourite host-plants, though the insect has been recorded as feeding on *Monolepis nuttalliana* and *Chenopodium album*, as well as on squashes and pumpkins. In Montana, while injury only occurs to sugar-beet, the weeds, *M. nuttalliana* and *Solanum triflorum*, and lucerne seem to be the normal food-plants, the larvae also feeding abundantly on young wheat. It is not clear whether *S. bituberosa* feeds normally on carrion, as do other members of this genus; in the author's opinion this seldom, if ever, occurs. Injury to sugar-beet occurs mainly in early May, both adults and larvae being abundant and injurious, though the greater part of the damage is done by the larvae. The presence of the beetles is generally due to migration from an adjoining field where some favourite food-plants occur as weeds.

A description of this beetle and details of its life-history and habits are given. Eggs are laid in the soil; the earliest date of oviposition being unknown. The larvae feed on the edges of the leaves, the attacks being made chiefly at night and the insect remaining hidden in the soil during the day. When fully grown, after about 24 days and following three successive moults, the larva burrows into the soil to a depth of one or two inches and there pupates. The adult feeds freely soon after emergence, but gradually spends longer and longer periods in the soil, until it finally disappears for hibernation. There is apparently but one brood in a year.

The remedies suggested include the keeping of all fields in the vicinity of beet crops as free from weeds as possible; when feasible, the beet foliage may be treated with an arsenical, but as the plants are generally attacked when quite small, this is seldom practicable. Poisoned bran mash scattered among the weeds near the fields where the insects are abundant has proved the best control. Another method is to place the poisoned bran under burlap bags in the beet fields. The adult beetles are attracted by the covering afforded and are killed by eating the poison.

Ainslie (G. G.). **Crambid Moths and Light.**—*Jl. Econ. Entom., Concord, N.H.*, **x**, no. 1, February 1917, pp. 114–123.

A series of experiments made during 1915 at Tennessee with trap-lights and poison baits for Crambid moths, while giving largely negative results, elucidated several new and useful facts. A total of 19,655 moths were taken at lighted windows during the period from 1st June to mid-October, the results being given in a series of tables and charts, comparing the times of appearance, relative numbers of the sexes, etc. The most numerous species was *Crambus teterrellus*, the moths of this species being uniformly abundant from spring to the end of September. Of the total number taken, 68 per cent. were males. It was very soon apparent that the great majority of the females appeared shortly after dusk, while the males almost all came much later in the evening; in fact a trap-lantern used from dusk for three hours will capture over 60 per cent. of the female moths that would be taken during the entire night. This explains the discrepancies between the statements of previous observers as to the sex of moths coming to light, when the time of trapping was not taken into consideration. The attraction to light is not determined by temperature, nor by humidity, though it is possible that barometric pressure may have some influence in this connection. Since the males are polygamous, their capture is of no importance. Mating usually takes place shortly after emergence of the females from the pupa, and before they come to light. Dissection of the females of several species taken leads to the conclusion that the moths have generally laid about 75 per cent. of their normal number of eggs before they are attracted to light.

Experiments in feeding, with a view to the use of poisoned baits, showed that moths fed with water only lived longer and produced more eggs than those kept unfed or than those supplied with diluted honey. Apparently the fat-bodies present in newly emerged moths are sufficient for the sustenance of the adult and for the development of the immature ova present on emergence from the pupa. Neither light-traps nor poisoned bait can therefore be used successfully against these insects.

Reeves (G. I.). **The Alfalfa Weevil Investigation.**—*Jl. Econ. Entom., Concord, N.H.*, **x**, no. 1, February 1917, pp. 123–131.

Oviposition in the case of this weevil [*Hypera variabilis*] begins before the spring growth of lucerne plants commences, in the dead stems which litter the ground and which already contain many living eggs deposited in the previous autumn. As soon as green shoots begin to appear, oviposition is continued in the green stems and the entire crop is frequently destroyed. The growth of a second crop is prevented by the larvae feeding upon the buds of the stubble. As a result of investigations undertaken by the Bureau of Entomology, several practical methods of control are suggested, none of which is perfect, but all are being used with some measure of success. Flooding the field with muddy water in early spring causes a deposit of silt to cover the surface of the ground, which imprisons the adults and the eggs contained in the dry stems. Where practicable, this method is very successful. Sprays consisting of arsenical poisons commonly used in orchards have been tried in various strengths and are all about

equally useful. Early spring spraying destroys both early larvae and adults; if necessary, a second spraying may be given to the stubble after the first crop has been removed. The cost of spraying varies according to the labour available, but has been worked out at about 3*s.* an acre. No injury to the lucerne nor to cattle fed upon it seems to result from the spraying. Pasturing as a control method is limited to the extent of the area that can be thus dealt with economically. By far the most effective method consists in dividing the field and pasturing the enclosures in rotation, turning all animals into each portion in turn. This permits the weevils to deposit their eggs at a considerable distance above ground, where they are destroyed by the cattle. Harrowing is resorted to only if the field still requires treatment after the first crop is cut. A temperature of 120° F. is fatal to the insects, and this can be produced by covering the surface of the field with a dust-mulch, which on becoming heated by the sun destroys all stages of the weevil. The field must be dry and the ground suitable for this treatment. The cost is about 13*s.* 6*d.* per acre, and must be followed by irrigation to start the growth of the second crop. Parasites of the weevil include an Ichneumonid, a species of *Bathyplectes*, which has become acclimatised in Utah. As many as 30 per cent. of the larvae present in mid-summer were found to be parasitised, but owing to the rapid reproduction of the weevil 99 per cent. must be destroyed merely to prevent the actual increase of the species. It is hoped that native American parasites which have been reared from the weevils may prove helpful in control.

In reply to a question concerning the possible spread of this pest to the eastern States, the author stated that at high altitudes the weevil is less destructive. In a climate where the weevils are not forced into inactivity by the heat of summer, the generations would be more spread out and feeding would be more continuous, but less concentrated, and therefore less harmful. This is probably the case in Italy.

Burgess (A. F.) & Griffin (E. L.). **A New Tree Banding Material for the Control of the Gipsy Moth.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 1, February 1917, pp. 131–135, 2 plates.

A tree-banding material very similar to that used in the German forests has been manufactured in the United States and is applied by means of an instrument consisting of a cylinder in one end of which is a small rectangular orifice. The cylinder is fitted with a plunger, which is forced forward in order to press the banding material slowly through the orifice. It is not necessary to scrape the bark before application, the orifice being simply placed against the trunk and the material forced out while the operator moves slowly round the tree until it is encircled.

Of several slightly varying mixtures experimented with, the one which gave the best results consisted of a high boiling neutral coal-tar oil, having a density of about 1·15 at 68° F., a soft coal-tar pitch, resin oil and commercial quicklime. A weighed quantity of the coal-tar pitch was transferred to a 10-gallon steam-jacketed kettle and heated until thin enough to run. Twice its weight of the coal-tar neutral oil was then run in and the mixture well stirred; the quicklime was slaked with a little water and was passed through a sieve having 10 meshes to the inch; 5 lb. of the pitch mixture, 16 lb.

of the coal-tar-neutral oil and 4 lb. slaked lime were then mixed and stirred, and when of a uniform consistency, 20 lb. of resin oil was added and stirred and then 10 lb. more of the coal-tar neutral oil; 25 minutes after the addition of the resin, the stirring was stopped and the material dumped into tubs; after standing for two days it was semi-solid and 2 lb. of the coal-tar neutral oil was stirred into each 50 lb. of this mixture in order to produce the desired oily surface. This material is cheaper than any successful tree-banding material previously made; the bands can remain on the trees during the winter and, if moistened with turpentine in the following spring, are effective for two seasons. This material does not run under a high temperature, nor harden after rain, but when used on dusty highways, requires occasional attention.

Ball (E. D.). **Efficiency and Economy in Grasshopper Control.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 1, February 1917, pp. 135–138, 1 fig.

The ideal control for grasshoppers is a combination of poison bait along fences and ditches or on crops like tomatoes, beans and maize, and the use of the grasshopper-catching machine on lucerne, sugar-beet, timothy grass and grain before flowering time. These methods have been dealt with in a previous paper by this author [see this *Review*, Ser. A, iii, p. 466].

Phillips (W. J.). **Report on *Isosoma* Investigations.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 1, February 1917, pp. 139–146, 2 plates.

Isosoma tritici is one of the most important pests of wheat in the Eastern States, but has not yet been found in the great wheat belt of the west. The injury it does has often been confused with that done by the Hessian fly [*Mayetiola destructor*]. There are 23 distinctly recognisable species of *Isosoma* occurring throughout the United States, 5 of which appear to be strictly western species, 12 strictly eastern and 6 that overlap. A new type of gall recently observed is apparently the work of a new and undescribed species of *Isosoma*, the galls always occurring in the leaf-sheath surrounding the head, and often showing a root-like growth at the base of the gall. These insects were found very difficult to breed in captivity, but from studies of individual species it seems certain that the three species occurring in wheat cannot be induced to breed in any other plant, and the same may be said for those species occurring in rye, barley, etc. This is a fact of economic importance in considering control measures. The eggs of *I. tritici* are laid between the fibrovascular bundles of wheat stems and hatch in 10 days. The gall begins to form before the hatching of the egg, disarranging the position of the fibrovascular bundles and causing the stems to fall. The larvae moult three or four times, and mature in about three weeks.

All the twelve species studied were found to be parthenogenetic. *Elymus* is the most favoured host of *Isosoma*, seven species having been reared from it; wheat and *Agropyron* sp. are attacked by three species; rye and blue-grass (*Poa pratensis*) by two; and barley, timothy (*Phleum pratense*), orchard grass (*Dactylis glomerata*), *Poa* sp., *Festuca* sp. and *Bromus* sp. by one each.

Numerous parasites have been reared from *Isosoma*, the majority of which are new. The most important parasites of *I. tritici* are *Ditropinotus aureoviridis*, Cwfd., and *Homoporus chalcidophagus*, Walsh; *Eurytoma bolteri*, Riley, var. *parva*, n., and *E. pater*, sp. n., are also important; the larva of the latter pierces the newly-formed gall and places its egg on the *Isosoma* larva, completing its development on the plant tissue after having consumed the host larva. The mite *Pediculoides ventricosus*, Newp., is another active agent in the control of *I. tritici*.

One of the most promising control measures at present practised is to plough under the wheat stubble as soon after harvest as possible, and sow clover or grass in August or September.

Dean (G. A.). **Results of Ten Years of Experimental Wheat Sowing to escape the Hessian Fly.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 1, February 1917, pp. 146–162.

Two of the most important factors to be considered by wheat growers are the time of sowing to produce the maximum yield, and the time for avoiding the Hessian fly [*Mayetiola destructor*]. Experimental wheat sowings have led to the conclusion that the best time to secure a maximum yield varies with the locality, the seasons and other conditions. Tables are given showing the results of experimental sowings in various localities of Kansas State: these results indicate that the maximum yield would be obtained in an average season by sowing a little earlier than the fly-free date. Sowing should be delayed until as near the fly-free date as possible, as, if the Hessian fly is present in damaging numbers and wheat is sown early, there is greater risk of injury. Early ploughing of the stubble has been found very effective in controlling the fly and also very successful in promoting the growth of wheat in autumn, and thus permits a later sowing. Late sowing, while preventing injury from the autumn brood of the fly, is no protection against the main brood of the following spring, which may migrate for several miles from an infested field or from self-sown wheat or old stubble. Community coöperation is the only means of eliminating these dangers.

McColloch (J. W.). **Wind as a Factor in the Dispersion of the Hessian Fly.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 1, February 1917, pp. 162–168.

Experiments with wind screens have disclosed the fact that Hessian fly [*Mayetiola destructor*] is undoubtedly dispersed by wind. The number of males caught in this fashion was practically negligible, but a large number of females were taken which had apparently been fertilised before flight, as they readily oviposited on wheat, all the eggs proving fertile. These flies have been known to be carried over hills to the uninfested valleys on the other side. The fact that they were uninjured when caught on a screen at two miles distance from infested wheat indicates that they could be carried much greater distances. In Kansas State, the prevailing winds are from the south and south-west, and it is noticeable that the spread of the fly has been slowest in a south-westerly direction. A light wind is the most favourable to flight;

when the wind velocity is over 20 miles an hour, the flies cling to the plants in the infested fields and are not wind-borne to any extent. These observations show that coöperation must be practised over large areas and that the individual grower cannot secure immunity from injury merely by the preparation of a good seed-bed and late planting. All stubble and self-sown wheat must be ploughed under in early autumn, as these are the greatest sources of infestation.

Collins (C. W.). **Methods used in determining Wind Dispersion of the Gipsy Moth and some other Insects.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 1, February 1917, pp. 170–177, 2 plates.

Additional data to those previously obtained [see this *Review*, Ser. A, iii, p. 710] have been collected on long distance wind dispersion of the larvae of the gipsy moth [*Lymantria dispar*] and these are given in the form of a table. The direction of the wind, recorded both at the time the larvae were taken and previously, indicated the source of infestation to be 19 to 30 miles distant. Besides gipsy moth larvae, other Lepidopterous insects were taken on the screens. These included a first stage larva of *Hemerocampa leucostigma*, S. & A., probably carried two-thirds of a mile at a wind velocity of 4 to 5 miles an hour. Specimens of a Noctuid and of a Geometrid were taken, but were too badly injured by removal from the tanglefoot to be specifically identified; their capture suggests possibilities for investigation with other species on these lines.

Crossman (S. S.). **Some Methods of colonizing imported Parasites and determining their Increase and Spread.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 1, February 1917, pp. 177–183, 1 fig.

This paper describes the methods of colonising the Encyrtids, *Anastatus bifasciatus*, Fonsc., and *Schedius kuvanae*, How., against the gipsy moth [*Lymantria dispar*]. *S. kuvanae* hibernates in the adult stage and begins to oviposit in gipsy moth eggs a week or two before these begin to hatch in the spring, the eggs constituting the host of the parasite until the summer. As soon as the gipsy moth eggs are laid in July, they are attacked by this parasite, which produces a fresh generation about every 25 days, until hibernation takes place, four generations and a partial fifth being completed each autumn.

A. bifasciatus, which has only one generation, oviposits in newly laid gipsy moth eggs, the larvae devouring the egg contents and remaining within the host throughout the winter and early summer, pupating and reaching the adult stage in time to attack the newly laid eggs of the next season. As there is thus only one generation per annum, the dispersion of *A. bifasciatus* is much slower than that of *S. kuvanae*.

Material for colonising *S. kuvanae* is obtained by breeding at the laboratory in gipsy moth eggs, spread over the bottom of trays. When a new generation of the parasite issues from these eggs, the trays are darkened above and holes are bored in the side into which are inserted paper cones which hold glass tubes. By placing electric lights in front of the tubes, a number of the parasites are induced to enter them; these tubes are then closed, a piece of paper smeared

with honey and water being inserted, and the tubes are then sent out for colonisation. Material for colonisation of *A. bifasciatus* is obtained from collections made in the field of gipsy moth eggs which are heavily parasitised. Similar trays are used to those described above, the eggs being covered with several layers of mosquito netting; as the non-parasitised eggs hatch, the larvae crawl up through the netting and into the glass tubes, and are then destroyed by immersion in kerosene. When hatching is complete, the eggs are passed from the trays over a gravity chute and at a certain point the egg-shells and dead eggs are drawn off by suction, while the heavier parasitised eggs pass into a tube at the base of the machine. These are measured off into cubic centimetres, each of which will consist, on an average, of 1,000 eggs, and are kept in a cool place until colonisation begins.

S. kuvanae is liberated in the autumn, in colonies of about 3,500. In the case of heavy infestation, the colonies are placed all along the roads in a town, 200 to 300 feet from the roadside and about 2 miles apart. The insects are then shaken out of the tube, the position of the colony being marked on a neighbouring tree and noted on a map.

A. bifasciatus is liberated during the spring as a larva within the host egg, and as the rate of dispersion is much slower than in the case of *S. kuvanae,* the colonies are placed every quarter of a mile along the infested roads, about 100 feet from the roadside. Each colony is placed in a small tin can with three exit-holes in the side, which is nailed to a tree and its position noted.

In order to determine the measure of success of each colonisation, collections of 100 gipsy moth egg-clusters are made from the neighbourhood of several colonies. These are examined in the laboratory and a record taken of the number of parasites that issue. For the purpose of measuring the dispersion and increase of *S. kuvanae,* four lines are taken to the cardinal points of the compass, using the site of a colony as the centre; collections of egg-clusters are made at the centre and at all points every 220 yards along these lines. For *A. bifasciatus,* eight lines are selected and collections made from the centre at every 100 feet for the first 200 yards and then every 100 yards. These lines are carried to the limit of the colony, which in some cases is nearly 2 miles. The collected eggs are sifted at the laboratory and the amount of parasitism determined. In the winter, when the larvae of *A. bifasciatus* are counted, they can be plainly seen in the gipsy moth eggs; while the numbers of *S. kuvanae* are estimated from the eggs that show exit holes of the parasite. A plan is given showing the method of measuring the percentage of parasitism by means of lines crossed by concentric circles in the manner described.

McColloch (J. W.). **A Method for the Study of Underground Insects.** —*Jl. Econ. Entom., Concord, N.H.*, x, no. 1, February 1917, pp. 183–187, 1 fig.

The construction of an underground cave placed eight feet below the ground level, with the roof two feet below the surface, has proved a very successful method for studying insects which injure roots and seeds, such as white grubs [*Lachnosterna*], wireworms, etc. A list is given of 17 species which were successfully carried through the winter in this way.

Three generations of *Eumicrosoma benefica*, parasite of the chinch bug [*Blissus leucoptera*], were reared in the cave and the life-cycle coincided with that of the controls reared in the field insectary. Eggs of the false wireworm and corn-ear worm [*Heliothis obsoleta*] hatched in the same length of time as those in the insectary. The temperature of the cave was practically constant at about 78°, the conditions evidently approximating those encountered in the field by the subterranean forms studied.

Zappe (M. P.). **Egg-laying Habits of** *Diprion simile*, **Hartig.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 1, February 1917, pp. 188–190.

The method of oviposition of this sawfly is described and a list is given of twelve species of *Pinus* on which the females laid their eggs. A few eggs were laid on white spruce, but the preferred species is *P. excelsa.* Parthenogenesis is common in this sawfly, the females apparently being entirely unaffected by the presence of the males. It is not yet certain whether the adults reared from virgin females are all males. Oviposition usually begins about one day after emergence from the pupa, the adult females living about 7 days, while those which do not oviposit die in 4 or 5 days. Eggs are laid for preference in the needles of the previous year's growth. There are two broods, which hatch in early May and early August, the two sometimes overlapping.

In the course of the discussion following this paper, Mr. R. L. Webster stated that he had reared *Harpiphorus maculatus* from unfertilised eggs, including one female, and Dr. C. G. Hewitt recorded that he had reared both sexes of the larch sawfly, *Lygaeonematus* (*Nematus*) *erichsoni*, from unfertilised eggs.

Manter (J. A.). **Notes on the Bean Weevil** (*Acanthoscelides* [*Bruchus*] *obtectus*), **Say**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 1, February 1917, pp. 190–193.

The larva of the bean weevil, *Bruchus obtectus*, always enters the bean at a point where it is in contact with another bean or some other object, the body of the larva being arched against this as an aid in penetrating the hard coating of the bean. Where these conditions are not present, the larva is apparently incapable of entering the bean. The larval stage lasts from 27 to 54 days. The pupal cell is formed just under the surface of the bean, part of the testa being eaten away so that emergence of the adult is easy. Adults live about 10 or 12 days. Fumigation with carbon bisulphide is the common method of control. The insects may also be killed by subjecting the beans to a temperature of 132° F. for about an hour, the beans being spread out in shallow trays. Cold storage or exposure to cold winter weather will prevent the weevils from breeding.

Davis (I. W.). **The Present Status of the Gipsy and Brown-tail Moths in Connecticut.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 1, February 1917, pp. 193–195.

The heaviest infestations of gipsy moth [*Lymantria dispar*] in Connecticut at the present time are in the north-eastern portion of the State with small scattered colonies further south, though scouting work

and control measures have reduced the numbers below injurious infestation. Wherever egg-clusters have been found they have been soaked with creosote, and in the case of larger infestations all brushwood has been cut and burnt. Tanglefoot bands were applied in the following spring to all infested trees and those within a radius of 100 feet of infested trees. Large infestations, where larvae were present, were sprayed in June with arsenate of lead.

Carr (E. G.). **Some New and Practical Methods for the Control of European Foulbrood.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 1, February 1917, pp. 197–200.

The essential factors in the treatment of European foulbrood of bees without destroying the combs are, a strong colony, the cessation of brood rearing in the diseased combs for a time, and good Italian stock. Since young bees are credited with cleaning up the combs, it is desirable that the colony be strengthened in this respect. This may be done by shaking combs of bees in front of the colony; the young bees enter the colony needing them, while the old bees fly back to their hive. To stop brood-rearing, the queen is removed or caged within the hive for a time, in order to give the colony an opportunity to clean out the diseased larvae. In re-queening, a young queen should be chosen from a disease-resisting stock, preferably an Italian one. An alternative method to that of deposing the queen is to cause the bees to construct a new brood nest, thus bringing about a temporary cessation of brood-rearing in the infected combs. This plan cannot be successful unless there is a heavy honey flow at the time. The principle of this method is that the cessation of egg-laying reduces the food for the bacillus of the disease, while the honey flow furnishes abundant healthy food for the larvae, stimulating the cell cleaners, so that the cells which contained diseased larvae are quickly cleaned out in preparation for the incoming nectar. The method of operating in this case is to put the queen in a hive with full sheets of foundation, over this an excluder and the diseased combs over all. The fact that bees have often proved very active in clearing out foulbrood during a nectar flow from buckwheat has led to the conclusion that a mild acid should be fed to diseased bees and this has been tried with some success. Further experiment is needed to prove the value of the acid treatment. A good deal of skill and knowledge is required for the successful carrying out of these methods, and for bee-keepers who cannot succeed with them the destruction of the diseased colony is the only remedy.

Schoene (W. J.). **The Weakness of our present System of Inspection with Regard to Foreign Shipments.** — *Jl. Econ. Entom., Concord, N. H.*, x, no. 1, February 1917, pp. 216–217.

Entomologists who endeavour to develop inspection work in the United States always have to contend with the fact that each State has authority to regulate the control of injurious pests according to the desires of the citizens composing that State, and the policy of one State is frequently radically different from that of its neighbours. In particular, the ideas of the importer or buyer of foreign produce rarely agree with the opinions of entomologists, as regards the restrictions

on foreign shipments. Another difficulty is the interference of persons having legislative authority, the powerful nursery interests of the States being thoroughly organised to protect their own interests to the hindrance of the successful prosecution of inspection workers. Inspection officials are requested to band themselves together and act as an organisation for the purpose of securing more stringent regulations regarding the importations of plants from foreign countries and greater uniformity in the treatment of the domestic problems within the country.

SASSCER (E. R.). **Important Foreign Insect Pests collected on Imported Nursery Stock in 1916.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 1, February 1917, pp. 219–223.

The following insects have been intercepted by State and Federal inspection during the year 1916: Eggs of the gipsy moth, *Lymantria* (*Porthetria*) *dispar*, L., on beech and apple stock from France, on *Thuja* and *Azalea* from Japan, and on rose from Holland; nests of the brown-tail moth, *Euproctis chrysorrhoea*, L., from France; eggs of the European tussock moth, *Orgyia* (*Notolophus*) *antiqua*, L., from France and Holland; pupae of a dagger moth, *Apatela auricoma*, F., from France and Holland. *Gracilaria zachrysa*, Meyr., has been frequently reported on azaleas from Holland, Belgium and Japan. *Porthesia similis*, Fuess., has been found on roses from Holland, and the leopard moth, *Zeuzera pyrina*, L., on apple from France. Dead larvae of the pink boll-worm, *Gelechia gossypiella*, Saund., were found in samples of China cotton enclosed in glass trays exhibited at the Panama-Pacific Exposition at San Francisco. This demonstrates the possibility of introducing new and injurious pests in plant products exhibited in this manner, in spite of every precaution having been taken to safeguard the material by the California authorities. Some 200 tons of cotton seed from Lagos, West Africa, which was taken as a prize cargo, was converted into fertilizer, owing to the fact that the seed had at some time suffered slight infestation with the pink boll worm. The dock and ship that had borne the seed were then thoroughly fumigated with hydrocyanic-acid gas. The mango weevil, *Cryptorrhynchus* (*Sternochetus*) *mangiferae*, F., occurred in mango seed from Siam and Japan, and the larvae of an apparently new species of *Conotrachelus* were found in avocado seed from Guatemala. *Prunus* seed from Japan had been injured by a species of *Anthonomus* closely related to *A. druparum*, of which several dead adults and larvae were taken. A pine prop used to support nursery stock was infested with *Myelophilus* (*Tomicus*) *piniperda*, L. Cocoons of the sawfly, *Emphytuscinctus*, L., were found on green ash sticks from England and on Manetti stock from France. *Tenthecoris bicolor*, Scott, infested orchids from Venezuela and Colombia; *Lachnus fasciatus*, Burm., was taken on *Picea glauca* and *Lachnus hyalinus*, Koch. on *P. excelsa* from France. *Psylla buxi*, L., occurred on boxwood from Holland, and a whitefly, *Aleurothrixus* sp., from Chile.

A list is given of the more important Coccids taken on imported stock with tables showing the amount of nursery stock offered for entry from the principal European sources during the past four years, and the number of species of insects reported by the inspectors from all countries.

Yingling (H. C.). **Aphid Eggs in Texas (Lat. 30°, 30′).**—*Jl. Econ. Entom., Concord, N.H.*, x. no. 1, February 1917, pp. 223–224.

While the opinion has been held for some time that oviparous reproduction in Aphids does not occur south of about latitude 35° to 36°, the author records the discovery, in December 1916, of two large clusters of eggs and wingless Aphids in the act of ovipositing on dogwood (*Cornus asperifolia*, Mich.) in Texas. These apparently belong to the species *Anoecia* (*Schizoneura*) *corni*, F., and are now under observation.

Weiss (H. B.). **Notes on several Insects not heretofore recorded from New Jersey.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 1, February 1917, p. 224.

The sawfly, *Janus abbreviatus*, Say, occurs as a rule in nurseries, the larvae living in the twigs of poplar and willow about the base of the trees. In the late summer the tips of the shoots die back and turn black in consequence of these attacks. *Diprion simile*, Htg., the European pine sawfly, was found for the first time in New Jersey in the summer of 1916, the attacks being confined to pine trees in nurseries. The insects were heavily parasitised by the Chalcid, *Monodontomerus dentipes*, Boh. *Phytomyza aquilegiae*, Hardy, the columbine leaf-miner, destroys the foliage early in the season, but later appears to be less destructive. The cockroach, *Blaberus discoidalis*, Serv., is frequently found in orchids imported from South America.

Webster (R. L.). **The Clover Weevil in Iowa.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 1, February 1917, p. 225.

Hypera punctata (clover leaf weevil) has been frequently recorded from various localities in Iowa and presumably occurs throughout the south and probably most of the eastern portion of the State.

Pink Boll Worm.—*Jl. Econ Entom., Concord, N.H.*, x, no. 1, February 1917, p. 225.

Specimens of cotton bolls infested with *Gelechia gossypiella* have been received at the Bureau of Entomology from Mexico, where this pest has been introduced in Egyptian seed imported for experimental purposes. An absolute quarantine was immediately decreed in the United States against Mexican cotton seed, and frequent inspections will be made in Texas in order to stamp out any colonies which may appear, a thorough exploration being conducted meantime in Mexico. The occurrence of this moth in Mexico constitutes a very grave menace to the cotton fields of the southern States.

Insecticides Purer.—*Jl. Econ. Entom., Concord, N.H.*, x, no. 1, February 1917, pp. 225–226.

The Insecticide and Fungicide Act of 1910 has resulted in a marked improvement in the quality of the substances placed on the market. The quality of the materials offered has been kept up to standard by the inspectors and the importation of incorrectly branded or adulterated insecticides has been stopped. The Board is investigating

the value of various commercial insecticides and fungicides, and experiments have been made to determine the action of potassium cyanide and other substances in the control of insect and plant diseases when injected into the tissues of plants.

DICKERSON (E. L.) & WEISS (H. B.). **The Azalea Lace-bug,** *Stephanitis pyrioides,* **Scott. (Tingitidae, Hemiptera).**—*Entom. News, Philadelphia,* xxviii, no. 3, March 1917, pp. 101–105, 1 plate.

This insect has been found in many localities in New Jersey, on various species of azalea, having evidently been introduced on evergreen azaleas from Japan. The nymphs and adults feed on the undersurfaces of the leaves, producing discoloration and frequently causing the leaves to drop. The winter is passed in the egg-stage, the first larvae hatching about the end of May. There are three broods in southern New Jersey, and only two in the central and northern parts of the State. All stages can be found together at the same time. The bugs may be controlled by spraying the underside of the leaves with whale-oil soap at the rate of 5 or 6 pounds to 50 gals. water; this should be applied shortly after the eggs of the first brood have hatched.

SANDERS (G. E.). **The Entomological Branch. Some Results of Spraying. Experiments in Nova Scotia in 1916.**—*Agric. Gaz. Canada, Ottawa,* iv, no. 2, February 1917, p. 114.

The matter in this article has been abstracted from another source [see this *Review,* Ser. A, v, p. 176].

WILCOX (A. M.). **Notes on Rearing Insects for Experimental Purposes and Life-history work.**—*Psyche, Boston,* xxiv, no. 1, February 1917, pp. 7–12, 2 plates.

In the rearing of insects for experimental work, provision should be made for an abundance of normal food, and for a suitable environment for the various stages; temperature and humidity must be regulated and disease and parasitism by other insects prevented. The apparatus used for this purpose, especially for rearing Lepidoptera, is described in detail.

For rearing fruit-flies of the genus *Drosophila,* test-tubes have been found very successful. The larvae were fed on banana-agar made by crushing four ripe bananas and allowing them to infuse in 500 c.c. of distilled water. The liquid is then strained off and 7½ grams of powered agar added and the whole cooked until the agar is dissolved. The flies will readily oviposit in this medium and many generations a year may be raised. A piece of filter paper is placed in the tubes for the maggots to pupate upon. The banana-agar is nearly transparent, which enables the feeding habits, etc., of the larvae to be noted.

CHILDS (L.). **Further Observations on the Control of the Fruit-tree Leaf-roller in the Hood River Valley.**—*Rept. Hood River Branch Expt. Sta. for 1916, Oregon Agric. Coll. Expt. Sta., Corvallis,* Sta. Bull. 141, February 1917, pp. 17–27, 2 tables.

The experimental work described in this article, which deals with the control of the fruit-tree leaf-roller (*Cacoecia argyrospila*), is based

on that already recorded [see this *Review*, Ser. A, iii, p, 758]. Its object was to determine the difference in the egg-destroying properties of early and late applications of the same strength of miscible oils; the result obtained by applying oil during unsettled cold weather; the relative merits of different commercial products in weak and strong dilutions; and the accuracy of the previous season's investigations It was found that the most important factor required in destroying leaf-roller eggs was the existence of fine and settled weather for several days following spraying; continued rainfall for four days following spraying destroyed the effectiveness of the oil. Two days of fine weather followed by continued rains permitted incomplete control, while seven fine days following application resulted in complete control. In this set of experiments a single brand of oil was used, so that variations in the penetration and killing properties, dependent upon specific gravity of different oils, were eliminated.

In the case of heavy oils, volatilisation and penetration are slow, and sufficient time must be allowed before activity ceases in order that it may accomplish penetration or sufficiently cover the eggs to give the desired results. Emulsions made from eastern or paraffin-base oils spread better than the western or asphaltum-base oils. The addition of one to two gallons of liquid soap to 100 gallons of emulsion greatly increases the spreading property of the spray.

Observations were also made as to the value of maintaining light traps during the egg-laying period. A tungsten electric-light trap was used which caught as many as 600 moths in a single night; 95% of these were males; 3% spent females; and 2% female moths containing eggs. This represented practically the average nightly catch over a period of several nights.

When miscible oils were used in the proportion of 6 gallons of oil to 100 gallons of water after the fruit buds began to show, considerable foliage injury was noticed, but the buds were not injured in sufficient numbers to reduce the crop or to cause injury to the tree other than to retard its development slightly.

CHILDS (L.). **Suggestions for the Control of the more serious Plant Diseases occurring at Hood River.**—*Rept. Hood River Branch Expt. Sta. for 1916, Oregon Agric. Coll. Expt. Sta., Corvallis,* Sta. Bull. 141, February 1917, pp. 28–32, 2 tables.

This article includes a spray calendar for the control of insect pests and diseases of apples. A table for the dilution of lime-sulphur at different degrees Baumé is also given.

CHILDS (L.). **Suggestions for the Control of the more serious Insect Pests occurring at Hood River.**—*Rept. Hood River Branch Expt. Sta. for 1916, Oregon Agric. Coll. Expt. Sta, Corvallis,* Sta. Bull. 141, February 1917, pp. 33–34.

For the control of the leaf-roller [*Cacoecia argyrospila*] the use of miscible oil (6 : 100) under warm, settled weather conditions only is advised. If brown aphis is also present, this spray will be equally useful; but against the Aphid alone, nicotine sulphate (1 : 1200) added to lime-sulphur solution (1 : 20) at 32° Bé., should be applied when the first leaves are unfolding on the fruit spurs. For woolly apple aphis

[*Eriosoma lanigerum*] the experimental work has been largely productive of negative results. Nicotine sulphate (1 : 1200) should be added to 1 : 40 lime-sulphur solution at 32° Bé. and the spray applied with care. It must not be applied during hot weather or within 10 to 14 days of anticipated hot weather, and drenching should be avoided. This pest can only be dealt with during the summer. Green aphis has been very prevalent during the two past seasons. No experimental work has been carried out in connection with it, but it was observed that orchards which were sprayed with nicotine (1 : 1200) were more free from this insect than adjoining unsprayed ones. For codling moth [*Cydia pomonella*] the usual control with arsenate of lead is advised. The application of lime-sulphur (1 : 10) just as the buds are bursting will control the pear-leaf blister mite [*Eriophyes pyri*]. San José scale [*Aspidiotus perniciosus*] is becoming prevalent in some orchards owing to lime-sulphur sprays not being required for other pests; these should be sprayed with lime-sulphur (1 : 10) just as the buds are bursting.

STONE (G. E.). **Shade Trees, Characteristics, Adaptation, Diseases and Care.**—*Massachusetts Agric. Expt. Sta., Amherst*, Bull. 170, September 1916, 264 pp., 109 figs. [Received 27th March 1917.]

One section of this bulletin deals with the injurious effect of various chemical substances on trees, especially those used as insecticides. Kerosene oil often causes serious injury, especially on trees having a thin bark; gas oil, sometimes used to kill egg-clusters of the gipsy moth [*Lymantria dispar*], may do considerable damage, though trees even seriously injured by it are able to produce perfect foliage, owing to the fact that the heavy oil soaking into the sapwood prevents it from cracking and maintains an uninterrupted supply of water from the roots. Miscible oils, which are used for spraying fruit trees to destroy San José scale [*Aspidiotus perniciosus*], sometimes cause local injury. No oils should be used on trees with smooth bark. Maples may be injured with arsenate of lead spray at a strength of 12 lb. of arsenate to 100 U.S. gals of water. Paris green, owing to its present uncertain composition, often scorches foliage. Of banding materials tanglefoot seems to be the only one which causes no injury if applied directly to the bark.

A description is given of the various high power spraying machines used in the State of Massachusetts.

YOTHERS (M. A.). **Bud Weevils and other Bud-eating Insects of Washington.**—*Washington State Agric. Expt. Sta., Pullman*, Bull. no. 124, February 1916, 43 pp., 3 figs., 6 plates, 8 tables. [Received 30th March 1917.]

Miscellaneous notes on the life-history and habits of certain species of Rhynchophora and other insects which have been found injuring the buds of fruit trees in the State of Washington are given. The various species investigated included the weevils, *Cercopeus artemisiae*, Pierce; *Cleonus lobigerinus*, Casey; *C. quadrilineatus*, Chev.; *Geoderces melanothrix*, Kirby; *Melamomphus luteus*, Horn; *M. nigrescens*, Pierce; *Mimetes setulosus*, Lac.; *Mylacus saccatus*, Lec.; *Panscopus aequalis*, Horn; *P. sulcirostris*, Pierce; *Sitones apacheana*, Casey;

Tosastes cinerascens, Pierce; *Tricolepsis* sp.; *Tychius lineellus*, Lec.; as well as other beetles, such as, *Cotalpa granicollis*, Hald.; *Eusattus muricatus*, Lec.; *Glyptoscelis alternata*, Crotch; *Polyphylla decemlineata*, Say; and *Syneta albida*, Lec.

A table is given showing the food-plants of these insects. Among orchard trees, practically all attack apples and most of them peaches, while a few attack pears and other fruits. Their principal native food-plant is the sagebrush (*Artemisia tridentata*) though several of them may also be found on the wild sunflower (*Balsamorrhiza sagittata*) and *Lupinus*. The weevils proper are found only on new land or that which has not been cleared of the native flora longer than one or two years.

Against these weevils in the larval stage the use of paper cone tree-protectors is the most effective and practical measure. These also are useful to some extent against the adults. The method of cutting these cones in the most economical manner and the sizes suitable for one- or two-year old trees are described. A heavy paper is used, the top and bottom edges of the cone measuring $3\frac{1}{4}$ and $10\frac{1}{2}$ inches respectively, while the depth of the paper is 6 inches. The papers are smeared on one side with a 3 or 4 inch band of tangle-foot, which should not reach to the bottom or broad edge as this makes it difficult to handle. A piece of cotton wadding is placed round the tree about 8 inches from the ground, and the paper carefully wrapped round it so that its bottom edge is 3 or 4 inches from the ground. The object of the cotton is to ensure a perfect contact between the cone and the tree. The cones should be placed in position as soon as the trees are planted out. Other methods of control are discussed, the results obtained by different experimenters being tabulated. A bibliography of 25 references is given.

MELANDER (A. L.) & YOTHERS (M. A.) **The Coulee Cricket.**—*State Coll. of Washington, Agric. Expt. Sta., Pullman*, Bull. no. 137, January 1917, 54 pp., 36 figs. 10 tables. [Received 30th March 1917.]

The coulee cricket (*Peranabrus scabricollis*, Thomas) occurs in restricted areas in Montana and Washington and in the latter State has appeared sporadically in immense migratory hordes, which devastated the whole of the vegetation growing in their path. It is practically omnivorous, feeding on desert plants, dung and dead animals. If other food is available, it will not eat peas, but when pressed for food it strips even the bitter sage brush. It is also cannabalistic throughout its life. It breeds in non-arable areas characterised by the presence of the scabland sage brush (*Artemisia rigida*), among the fallen leaves of which the newly hatched crickets secure protection in early spring. During the first four instars, the insects feed in the breeding grounds; at the fifth they begin moving in bands and spread over miles of country. Eggs are laid singly, usually at the base of grass stems, each female averaging about fifty; they are deposited during the migrations whenever the insects come to a favourable area. The eggs are sometimes parasitised by a Scelionid wasp (*Sparasion pilosum*, Ashm.), and small crickets are preyed upon by a Carabid beetle (*Calosoma zimmermanni*), robber flies (*Cyrtopogon maculosus*), and various ants, though not to any great extent.

To control this pest it is better to try to destroy the young crickets in the restricted breeding grounds, than to wait until they are migrating. Spraying with a 5 to 10% kerosene emulsion will destroy newly-hatched individuals, but is of no use after the first moult. Poisoned bait composed of fresh horse-manure mixed into a paste with one to two per cent. of its weight of sodium arsenate, previously dissolved in sufficient water, and lightly scattered round the bushes frequented by the crickets, is an effective measure of control. Straw placed in small heaps in the breeding districts will attract the crickets at night and, if burnt before they leave them the next day, immense numbers may thus be destroyed. A large gasoline blast torch may also be used with good results. To check migratory crickets vertical walled ditches containing deeper pitfalls should be dug across their path. The insects massing in the pits quickly smother each other and, if soon spread out to dry, they form valuable food for pigs and fowls. A fencing made of 1 by 8 inch planking joined end to end and stood on edge and furnished with frequent pits is sometimes used instead of ditches.

Owing to the sparsely populated nature of the country contiguous to the breeding ground of this cricket, the cost of its suppression should devolve on the community and not on the ranchers first affected.

MELANDER (A. L.). **Winter Sprays: Lime-Sulphur and Crude Oil Emulsions.**—*Washington Agric. Expt. Sta., Pullman,* Popular Bull. no. 107, February 1917, 12 pp.

This bulletin is a revision of a previous one which has already been abstracted [see this *Review*, Ser. A, ii, p. 322]. The value of soda-sulphur preparations used as substitutes for lime-sulphur is discussed; these are considered more costly in view of the results they give than standard lime-sulphur. While 90 per cent. of the solids in lime-sulphur theoretically have killing powers, only 50 per cent. of the material in the soda-sulphur preparations is thus available. Hence they should be used at a greater concentration than lime-sulphur in order to attain similar results; thus 100 lb. of dry soda-sulphur dissolved in 200 U.S. gals. of water would give a spray approximately equivalent to 40 lb. sulphur and 20 lb. lime, or 14 U.S. gals. of standard concentrate (33°) lime-sulphur diluted in 200 U.S. gals. of water. The fact that much weaker soda-sulphur sprays have given satisfactory field results is paralleled by similar satisfactory results following the use of lime-sulphur in more dilute solutions than the $1 : \frac{1}{2} : 5$ formula. Soda-sulphur is apt to scorch foliage. Tests with barium-sulphur have given unsatisfactory results. A liquid soda-sulphur spray can be simply prepared by stirring 1 lb. concentrated lye or potash and $1\frac{1}{2}$ lb. ground sulphur in $\frac{3}{4}$ U.S. gal. of hot water. Chemical reaction is at once set up and in a few minutes the wash is ready. It should be diluted to 3 or 4 U.S. gals. for use; nearly twice as much should be used as of lime-sulphur. Attention is drawn to the necessity for care in making oils into an emulsion, factory-made miscible oil being recommended for the purpose. Directions for making fish-oil soap are as follows: Boil 20 U.S. gals. of water; dissolve in it 7 lb. lye or potash, 98 per cent.; then stir in 5 U.S. gals. of fish-oil and boil for 2 hours. This should make about 130 lb. of gelatinous soap.

Knowles (C. H.). **Memorandum of Work in Connection with Scale on Bananas.**—*Dept. Agric. Fiji, Suva,* Pamphlet 6, 20th June 1914, 3 pp. [Received 30th March 1917.]

This pamphlet describes the work done by the Department of Agriculture in connection with the outbreak of scale-insects on bananas dating from October 1912, when the presence of this pest was first noticed, up to June 1914. The various control measures which have been instituted are described [see this *Review*, Ser. A, i, p. 136, and iii, p. 91]. The results obtained on the growing plants were less satisfactory than might have been expected, probably owing to carelessness in the methods of application rather than to the sprays recommended. The importance of fumigation of bananas before exportation, as a supplementary measure to spraying, is emphasised.

Knowles (C. H.). **Cacao.**—*Dept. Agric., Fiji, Suva,* Pamphlet no. 17, 1916, 4 pp. [Received 30th March 1917.]

The insect pests of cacao recorded in this pamphlet include the rose beetle (*Adoretus umbrosus*), which destroys the leaves, practically defoliating young plants. The latter may be protected by placing pieces of split bamboo about an inch wide and about 18 inches long round the plants in the form of a fence. Mealy bugs [*Pseudococcus*], if unchecked, are capable of doing extensive damage to the pods, which, if heavily infested, become completely withered and dried up. This pest is easily controlled by spraying with kerosene or lime-sulphur. Two shot-hole borers, *Xylopertha lifuana* and *X. castanoptera*, attack the trunk and branches of cacao trees. The former also attacks *Cassia nodosa*, a shade tree. The damage done by these beetles is not sufficiently extensive at present to call for remedial measures.

Maize.—*Dept. Agric., Fiji, Suva,* Pamphlet no. 18, 1916, 5 pp. [Received 30th March 1917.]

The chief pests of maize in Fiji attack the stored grain and include a Pyralid moth and the grain weevil (*Calandra granaria*). A method of destroying these and other insects by super-heating the store-houses is now coming into use in large mills and not only proves cheaper than fumigation, but dispenses with the risk of fire connected with the use of carbon bisulphide or of poisoning with cyanide of potassium. On a small scale, however, carbon bisulphide is very satisfactory, if the necessary precautions are taken.

The Lime (*Citrus limonum*).—*Dept. Agric., Fiji, Suva,* Pamphlet no. 22, 1916, 4 pp. [Received 30th March 1917.]

The insect pests of limes in Fiji are the orange snow scale (*Chionaspis citri*) and the California red scale (*Chrysomphalus aurantii*). These scale-insects often do considerable damage before their presence is detected. Periodical spraying with lime-sulphur or other insecticides should be carried out and a constant watch maintained for the appearance of the scale, as immediate treatment is advisable.

van Zwaluwenburg (R. H.). **Report of the Entomologist.**—*Rept. Porto Rico Agric. Expt. Sta. 1915, Washington, D.C.*, 23 November 1916, pp. 42–45. [Received 30th March 1917.]

The principal sugar-cane pests were white grubs [*Lachnosterna*] and the moth borer [*Diatraea*]. The pests of coffee included the coffee weevil (*Lachnopus* sp.), the leaf-miner [*Leucoptera coffeella*] and *Myrmelachista ambigua ramulorum*. Experiments were made with native trees in the hopes of finding one on which this ant could not form colonies of scale-insects, but no suitable one was found.

Among garden insects, the changa (*Scapteriscus didactylus*), the flea beetle (*Systena basalis*) on beans, beets and okra, and a weevil (*Baris torquatus*) on egg-plant, were very troublesome. The adults of this last are very common on *Solanum torvum*, but the young stages have only been found on egg-plant. A lace-wing (*Corythaica monacha*) is also very common on egg-plant. A 1 : 10 kerosene emulsion spray will act as an effective control of this insect.

Furniture and wood-work in houses were attacked by two species of termites, *Eutermes morio* and *Leucotermes* sp. The former may be cheaply and effectively controlled by placing liberal quantities of any powdered arsenical poison in the runways and nests. London purple gives quicker results than Paris green, probably owing to the finer division of the particles. The other species is most effectively controlled by fumigation with hydrocyanic acid.

Young coconut trees are often killed as the result of damage done by the adult rhinoceros beetle (*Strategus quadrifoveatus*). The larvae of this beetle only feed in dead wood, so that if care is taken to have no logs lying about, no breeding places will be left in the vicinity and the chances of attack by the adults will be lessened. The larval period is a long one, probably requiring over a year for completion. Some growers make piles of decaying logs and cover them loosely with earth; these are inspected about once in six months, and all larvae found in them destroyed.

Young mahogany trees are often attacked by the Bostrychid, *Apate francisca*. The young stages are only found in dead trees, but the adult often so weakens the tree that it is easily broken in a heavy wind. The adults may be killed by running a stiff wire into the burrows. This beetle also attacks coffee, citrus and pigeon-peas.

Miscellaneous insects included a Lepidopterous larva attacking ornamental palms and a Noctuid (probably *Eriopus floridensis*) on ornamental ferns. *Aspidiotus destructor* often seriously injures coconuts, especially in the dry parts of the island. The best method of control on young trees is an oil spray. On large trees the removal and destruction of the leaves most heavily infested is advised. *Sipha flava*, the yellow Aphid of sugar-cane, was very numerous in small areas, but is for the most part effectively controlled by predaceous enemies. Oleanders are often attacked by the larvae of *Empyreuma lichas*. Hand-picking the larvae is the best means of control.

Gillette (C. P.). **Habits of Some Common Plant Lice.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vi, no. 2, February 1917, pp. 59–63, 2 figs.

This paper gives a popular account of the habits of some of the commoner Aphids. They are preyed upon by Coccinellids, in both

their larval and adult stages, and Syrphid flies, while many species are destroyed in countless numbers by Hymenopterous parasites, of which the Braconids are the most important. The gall-forming species, such as *Eriosoma americanum* on the elm and *E. lanigerum* on the apple, are destroyed by Capsids.

The green peach aphis, *Myzus persicae*, is generally distributed wherever peaches or plums are grown. Early in the season it attacks the leaves, causing them to curl and turn yellow, and also injures the young peaches, which shrivel and drop. A few of the young stem-mothers acquire wings and migrate, a large proportion of the third generation doing the same, and usually by the middle of June nearly every individual has developed wings and gone in search of some herbaceous plant on which it can feed until about the first week of September. Of about seventy food-plants recorded in connection with this insect in Colorado, the following are the most important: cabbage, cauliflower, rape, lettuce, tomato, potato, beet and radish. In the autumn the migrants return preferably to the peach, on the leaves of which the egg-laying females are deposited. By the time these are about half-grown, the winged males that have developed on the summer host also appear on the peach leaves. The summer form of this species is sometimes found living over the winter in protected places on the green stems and leaves of herbaceous plants, usually its summer hosts. The migration to a summer host of a different kind from the winter one is useful to the species as a means of eluding natural enemies, and the return to a woody plant for the deposition of eggs is of great importance in the provision of food for the young individuals in early spring.

Other Aphids which have this migratory habit, and which are especially troublesome to fruit-growers, include: the green aphis (*Aphis avenae*), which is common on apples early in the season, migrating to oats for the summer; the rosy aphis (*Aphis sorbi*), which migrates to plantains for the summer; the clover aphis (*Aphis bakeri*), which hatches on apple and thorn twigs and then goes to the clover, especially red clover, for the remainder of the year; the powdery plum and prune aphis (*Hyalopterus arundinis*), which is abundant on the leaves of these trees in early summer and then migrates to coarse grasses, especially the reed grass (*Phragmites* sp.), on which it remains until the autumn, when it returns to plums.

Some of the species attacking shade trees and ornamental shrubs also have migratory habits. The Aphid causing the leaf-cluster gall on the American elm, when transferred to the apple, produces colonies indistinguishable from those of the woolly aphis, *Eriosoma lanigerum*, which have arisen from hibernating forms on the apple. Though the woolly aphis is able to live from year to year without receiving migrants from the elm and apparently thrives in regions where the elm is not grown, there seems to be a tendency to migrate between these hosts to some extent. The snowball aphis (*Aphis viburnicola*) migrates in the second generation to unknown hosts, and returns in September to the snowball. *Chermes cooleyi* migrates from the blue and Engelmann spruces to the Douglas fir in July, while the form *C. cooleyi* var. *coweni*, which develops on the leaves of the Douglas fir, returns to the blue and Engelmann spruces in the same month, becoming the hibernating stem-mothers [see this *Review*,

Ser, A, iv, p. 523]. These trees therefore should not be planted near each other. Cottonwoods are the winter hosts of the beet aphis (*Pemphigus betae*), though a percentage of these Aphids always spend the winter in the ground.

The green apple aphis (*Aphis pomi*), the black cherry aphis (*Myzus cerasi*), the box elder aphis (*Chaitophorus negundinis*) and the dandelion aphis (*Macrosiphum taraxicis*), entirely lack this habit of alternating the food-plants.

The successful control of Aphids therefore depends largely upon knowing the life-history of the species in question and the enemies that are associated with it.

Davidson (W. M.). **The Cat-tail Rush,** *Typha latifolia,* **as a Summer Host of Injurious Insects.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vi, no. 2, February 1917, pp. 64–65, 1 fig.

The mealy plum aphis (*Hyalopterus arundinis*, F.) is the chief insect pest that feeds on the cat-tail rush (*Typha latifolia*). Spring migrants to this plant begin to arrive from the winter hosts, plums and apricots, at the end of April and continue to do so until the end of July. A series of wingless generations ensues until the middle of October, when the winged autumn migrants and the winged males appear. The colonies continue forming as late as December, the autumn migration lasting over a period of one and a half months. From four to ten generations appear to occur on the rush, the Aphids being found in colonies on both sides of the blades, usually near the tips. Other Aphids that may be found on this rush during the summer are: the reddish-brown plum aphis (*Rhopalosiphum nymphaeae*, L.), which also uses other water-plants, such as *Alisma*, *Nymphaea* and *Potamogeton*, as summer hosts; the grain aphis (*Macrosiphum granarium*, Kirby); the oat aphis (*Aphis avenae*, F.), which may be found on cat-tail in summer and autumn, and in winter and spring in California on grains and grasses, including maize. It normally hibernates in the egg-stage on rosaceous plants including the apple. A small black aphis (*Aphis gossypii*, Glov.) also occurs in small numbers on cat-tail during the summer and autumn months. Red spider mites (*Tetranychus* sp.) sometimes feed in abundance on this rush during the summer months.

Maskew (F.). **Quarantine Division.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vi, no. 2, February 1917, pp. 66–67.

The following pests were intercepted during the month of December, 1916:—From Brazil: Lepidopterous larvae in orchids. From China: *Cylas formicarius* in sweet potatoes and weevil larvae in beans. From Hawaii: *Pseudococcus bromeliae* and *Diaspis bromeliae* on pineapples, *Coccus longulus* on betel leaves, and *Chrysomphalus aonidum* and *Parlatoria* sp. on coconuts. From Holland: *Lepidosaphes ulmi* on boxwood, *Aspidiotus britannicus*, *A. hederae* and *Coccus hesperidum* on bay trees and holly. From Japan: Lepidopterous larvae in chili peppers, *Pseudaonidia duplex* on camellias, *Thyridopterix* sp. on daphne. From Mexico: *Trypeta ludens* in guavas, *Howardia biclavis* on unidentified plants. From Papute: Coleopterous larvae in sugar-cane, *Lepidosaphes beckii* on oranges and limes. From Belgium: *Aleurodes* sp. on azaleas, *Aspidiotus britannicus* and *Coccus hesperidum* on bay trees. From Florida: *Lepidosaphes beckii* on grape fruit.

From France: unidentified weevils in tree seeds. From North Carolina: *Aulacaspis pentagona* on loquat, *Aleurodes* sp. on Cape jasmine. From New York: *Diaspis boisduvali, Coccus hesperidum, Saissetia hemisphaerica* and *Aspidiotus* sp. on orchids; *Hemichionaspis aspidistrae, C. hesperidum* and *Pseudococcus longispinus* on ferns. From Pennsylvania: *Coccus hesperidum* on *Anthurium scherzerianum*. From Utah: *Lepidosaphes beckii* and *Phomopsis citri* on grape-fruit.

SANDERS (G. E.). **What Sprays shall we use in 1917?**—*Canadian Horticulturist, Toronto*, xl, no. 3, March 1917, pp. 73–74, 2 figs.

Five sprayings are recommended in this paper for apple orchards in Nova Scotia. The first is given when the leaves about the blossom clusters show green; for canker worm, this should be a few days later. It should consist of 3 gals. commercial strength lime-sulphur to 100 gals. water, adding 2lb. powdered arsenate of lime. If a thorough drenching with a drive nozzle at 200 lb. pressure be given, apple scab, budmoth [*Eucosma ocellana*], brown-tail moth [*Euproctis chrysorrhoea*], canker worm and tent caterpillars [*Malacosoma*] are destroyed. If Aphids are present, $\frac{3}{4}$ pint nicotine sulphate should be added to the spray. The second spray is required when the blossom buds show pink at the tips; $2\frac{1}{3}$ gals. commercial concentrate lime-sulphur is used to 100 gals. water, adding 2 lb. powdered calcium arsenate. For severe infestation of green apple bug [*Lygus communis*] the tree must be banded with tree tanglefoot before spraying and kept clean until 7th July. The third spray should be applied when the blossoms fall and consists of about 2 gals. lime-sulphur to 100 gals. water, adding $1\frac{1}{2}$ lb. powdered arsenate of lime. For these later applications a drive nozzle is not suitable and a calyx nozzle should be used, maintaining the pressure at 200 lb. For the fourth spray, in view of the fact that Bordeaux mixture, when used immediately after the blossoms fall, causes russetting, and that lime-sulphur is most harmful at this time, a 7 : 7 : 100 Bordeaux mixture is recommended for use two weeks after the blossoms fall, or later, in preference to dilute lime-sulphur. For speed in making the mixture the following formula is given: to each 100 gals. tank capacity use 7 lb. of bluestone dissolved in water, fill the tank with water, then add 7 lb. or more of hydrated lime. These should be well mixed and the poison added in the form of 5 lb. paste arsenate of lead or 2 lb. powdered arsenate of lime; the spray is then ready. The mixture should be tested until it turns litmus paper blue. Additional pests destroyed by this spray include the tussock moth [*Hemerocampa*], fall webworm [*Hyphantria cunea*], red-humped catterpillar [*Schizura concinna*] and yellow-necked caterpillar [*Datana ministra*]. A fifth spraying is recommended in very wet seasons for the control of apple scab or when tussock moth and brown-tail caterpillars are abundant. This is a repetition of the fourth spray and is given 10 or 14 days later.

MUIR (F.). **A new Formosan *Purohita* (Delphacidae).**—*Philippine Jl. Science, Manila*, xi, Sec. D, no. 5, September 1916, p. 311. [Received 6th March 1917.]

A description is given of a Delphacid, *Purohita maculata*, sp. n., living under the leaf-sheaths of the broad-leaved bamboo (*Dendrocalamus*) in Formosa.

Oberstein (—). *Chortophila cilicrura,* **Rond., und** *Thereva* **spec., zwei neue Roggenschädlinge in Schlesien** [*Chortophila cilicrura* **and** *Thereva* **sp., two new Pests of Rye in Silesia**].—*Zeitschr. f. Pflanzenkr., Stuttgart,* xxvi, no. 5, 30th July 1916, pp. 277–280. [Received 30th March 1917.]

This paper records the larvae of the Anthomyid, *Chortophila cilicrura,* Rond., and of *Thereva* sp., as injuring rye in Silesia.

Schoevers (T. A. C.). **Iets over bestrijding van schadelijk insekten door zwammen en bakteriën.** [The Control of injurious Insects by Fungi and Bacteria.]—*Tijdschr. over Plantenziekten, Wageningen,* xxii, no. 6, December 1916, pp. 131–202.

This paper is a valuable compilation of matter already published relating to the control of injurious insects by fungi and bacteria [see also this *Review,* Ser. A, iv, p. 301]. It includes a bibliography of 255 references.

Como destruir os Grillos-toupeira, [The Destruction of Mole-crickets.] —*Chacaras e Quintaes, Rio de Janeiro,* xv, no 1, 15th January 1917, pp. 15–16.

In the State of Ceará (Brazil) young sugar-cane is severely injured by *Gryllotalpa tetradactyla,* Perty. The use of trap-pots and fumigation with carbon bisulphide are the measures recommended against it.

Conceição (J.). **As Saúvas** (*Atta sexdens* **L.**) **e sua Extincção.** [*Atta sexdens* and its Destruction.]—*Chacaras e Quintaes, Rio de Janeiro,* xv, no. 1, 15th January 1917, pp. 30–38, 4 figs.

A description is given in this article of a new fumigator for use against *Atta sexdens,* L., which is a serious pest in Brazil. This apparatus is easily carried and worked by one person. The fumigant, which contains sulphide of arsenic, is made up in the form of a pierced tablet fitting on to a skewer which is thrust into the ground near the main gallery of the ant's nest. Over the fumigant is placed a bell with sharp edges which is pressed into the ground. At the top of the bell is a glazed aperture, permitting the progress of combustion being watched, and a nozzle to which a piece of flexible tubing is attached. The other end of the tubing is fastened to a circular metal box containing a fan which the operator works by means of a handle. For use the ground around the main gallery is levelled to accomodate the bell, the skewer is placed in position and the fumigant fixed on it and lighted. Each tablet produces about 1,600 cubic feet of a yellow, asphyxiating vapour, about three times as heavy as air ; this quantity is sufficient for a medium-sized nest, though for large ones two or three tablets are required. Immediately combustion is completed the bell must be removed and the hole closed with earth. Within the nest, the vapour condenses and leaves a poisonous deposit everywhere. The tablets may also be used for fumigating trees, enclosed in a tent for the purpose.

Broca da Madeira morta das Arvores fructiferas. [A Borer in the dead wood of Fruit Trees.]—*Chacaras e Quintaes, Rio de Janeiro,* xv, no. 1, 15th January 1917, p. 40.

Specimens of the Cerambycid, *Dorcacerus barbatus*, Oliv., are recorded from orange trees at Rio de Janeiro. Though dead wood is preferably attacked, which points to the removal of dead twigs, etc., as a control measure, the injury done by this borer is not confined to it.

Insectos nocivos ás Laranjeiras. [Insect Pests of Orange Trees.]—*Chacaras e Quintaes, Rio de Janeiro,* xv, no. 1, 15th January 1917, p. 41.

The Lamellicorn, *Cyclocephala sanguinicollis*, Burm., is said to feed on the roots of orange trees in Brazil. An Erotylid, *Morphoides* (*Barytapus*) *abdominalis*, Oliv., lives under the bark of these and other trees, and the Chrysomelid, *Colaspis prunosa*, Lef., feeds on the flowers.

LEGISLATION.

The Insect Pest and Quarantine Ordinance, No. 5 of 1901.—Extract from *Ceylon Government Gazette, Colombo,* no. 6839, 5th December 1916, 1 p. [Received 7th April 1917.]

The regulations made under the Insect Pest and Quarantine Ordinance, dated 16th October 1914, are revoked and others substituted. Regulation (1) defines the terms infested area and plantation. Regulation (2) requires that the superintendent or person in charge of any plantation not declared an infested area, upon which shot-hole borer [*Xyleborus fornicatus*] is present, shall report immediately in writing its presence to the Director of Agriculture. Regulation (3) authorises the Director of Agriculture, when satisfied of the presence of this pest of tea in any plantation, to declare the plantation or the Chief Headman's division of the revenue district or any part thereof an infested area. Regulation (4) provides for the release of any infested area as soon as the Director of Agriculture is satisfied that such area is no longer infested. Regulation (5) authorises the Director of Agriculture to enter any estate or garden at any reasonable time to ascertain whether shot-hole borer is present. The two remaining regulations deal with the conditions under which tea plants or parts of plants, other than leaf for manufacture or tea-seed, may be removed from infested areas.

The Insect Pest and Quarantine Order, No. 5 of 1901.—Extract from *Ceylon Government Gazette, Colombo,* no. 6847, 12th January 1917. [Received 7th April 1917.]

This extract contains a list of the estates that have been declared infested areas owing to the presence of shot-hole borer [*Xyleborus fornicatus*], under the regulations given above. A further extract, dated 2nd February 1917, adds two more estates to this list.

NOTICES.

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RITZEMA BOS (J.). **Ziekten en beschadigingen, veroorzaakt door dieren.** [Diseases and Damage caused by Animals.]—*Meded. R. Hoogere Land-, Tuin- en Boschbouwschool, Wageningen*, xi, no. 5, 1917, pp. 169–250,

This paper is a section of the report of the Instituut voor Phytopathologie, Wageningen, for the year 1914, portions of which have already been published [see this *Review*, Ser. A, iii, 194, 195, 644].

Nematodes. *Tylenchus devastatrix*, Kühn, injured rye, *Hyacinthus candicans* and *H. orientalis*, and was probably the species responsible for damage to strawberry plants. *Aphelenchus fragariae*, Ritz. Bos, and *A. ormerodis*, Ritz. Bos, were received on strawberry plants. Chrysanthemum leaves were attacked by *A. ritzema-bosi*, Schwarz. *Heterodera schachtii*, Schmidt, occurred on beet and oats, while *H. radicicola*, Greef, was found in roses, *Delphinium* and cucumber. *Plectus parietinus*, Bast., occurred in strawberry plants.

Thysanoptera. Against *Liothrips setinodis*, Reut., on *Lilium pardalinum*, dipping the bulbs for 15 minutes in a solution of 2 per cent. of soft soap and 1 per cent. methylated spirit proved ineffectual; with carbon bisulphide, 500 c.c. per 40 cubic feet, the insects became stupefied, but most of them revived, even after fumigation for four hours. Fumigation with benzine gave better results. The possibility of attacks on cereals by thrips, especially *Limothrips cerealium*, Hal., being influenced by the date of sowing was tested by sowing three lots of oats on 31st March, 10th April, and 22nd April respectively. When harvested in August, these lots showed great differences, the first being almost uninjured, the second only slightly so, while the third was considerably damaged. Such experiments should be repeated for several years in order to obtain conclusive data.

Lepidoptera. From cocoons collected from band-traps on apple trees *Swammerdammia pyrella*, de Vill., was bred. Defoliation of a pear tree was caused by the larvae from eggs laid by the first generation of *Leucoptera* (*Cemiostoma*) *scitella*, Z. (pear-leaf blister moth). *Phyllorycter* (*Lithocolletis*) *concomitella*, Bankes, infested apple trees. This leaf-miner can be reduced in numbers by picking and burning infested leaves and removing fallen ones. Greenhouse roses were attacked by a leaf-rolling caterpillar, either *Eucosma* (*Spilonota*) *roborana*, Tr., or *E.* (*S.*) *rosaecolana*, Dbl. An attempt was made to control this pest by capturing the moths and by burning the infested buds. Fruit trees, especially cherries, were attacked by *Cheimatobia brumata*. Many eggs are deposited on the trunks between the ground and the sticky banding, and as even the best samples of the latter lose their efficiency by March, many of the caterpillars are able to reach the crown of the tree. A 10 per cent. solution of carbolineum, which may safely be used on the trunk, will kill such eggs and also the hibernating pupae of *Cydia pomonella* and *Porthesia similis*, Fuessl. For experimental purposes some cherry trees were banded, while others, left unbanded, were sprayed in the second half of February with a $7\frac{1}{2}$ per cent. solution of carbolineum. None of these were attacked by *C. brumata*, whereas untreated control trees were injured. This shows that, when banding has not been applied or where its use is impossible, as in the case of bushes, one spraying with carbolineum provides a sufficient control. The constant occurrence of *Chloroclystis*

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(*Eupithecia*) *rectangulata*, L., seemed to point to this Geometrid as the cause of injury to banded trees. As the females can fly, either Paris green or lead arsenate should be used against it. *Asparagus plumosus* was injured by *Acidalia bisetata*, Hüfn., which has never before been reported as injuring cultivated plants.

Diptera. Adult larvae of *Psila rosae*, F., injured caraway plants at the end of February and early in March, two-year-old plants in one district being so damaged that most of them had to be ploughed under; one-year-old plants were said to be unaffected. Caraway is only harvested once and the crop is a two-year one if planted among peas, beans or spinach, and a three-year one among flax or clover. The less frequent cultivation of caraway would therefore be an efficient control if uniformly practised in entire districts. French and other beans were injured by *Chortophila cilicrura*, Rond. The larvae of *Eumerus strigatus*, F. (*lunulatus*, Meig.) occurred in narcissus bulbs and sometimes also infest onions and shalots. In a district where gherkins are cultivated a pest new to the locality appeared and proved to be the larva of a species of *Sciara*. Of various insecticides tested, benzine, 5 to 7 cc. per plant, appeared to be the most effective. The benzine is poured into a hole made by thrusting a stick in a slanting direction beneath the plant.

Coleoptera. Strawberries were attacked by a beetle, probably *Harpalus ruficornis*, F. *Cercyon analis*, Payk., was reported as occurring abundantly on cucumbers, the plants being gnawed at the collar. A one per thousand solution of Paris green appeared to be effective against it. The larvae of *Lema cyanella*, L., were present in large numbers on oats, skeletonising the leaves longitudinally. A field of rye had to be ploughed up owing to infestation by a beetle, believed to be *Phyllotreta vittula*, Redt. Young asparagus suffered severely from attacks of *Cneorhinus plagiatus*, Schall. (*geminatus*, F.). Spraying with 0·5 per cent. lead arsenate proved a complete control both for this beetle and *Strophosomus curvipes*, Thoms., on the same plants. Climbing roses were seriously damaged by *S. rufipes*, Steph., and *S. capitatus*, de G., which curiously enough did no injury to bush roses, though numbers were growing close by. The larvae of *Otiorrhynchus sulcatus*, L., did considerable injury to strawberries. Against *Phyllobius calcaratus*, F., on pear trees a 0·5 per cent. lead arsenate spray checked defoliation and in 1915 no more beetles were noticed.

Hymenoptera. The Chalcid, *Isosoma* (*Eurytoma*) *orchidearum*, Westw., occurred on *Cattleya*. The simplest and best control is the removal and burning of the infested shoots and bulbs of these orchids.

Rhynchota. *Lygus pabulinus*, L., did much damage to guelder-roses; dusting with American insect powder proved satisfactory. Comparative tests with carbolineum 1 per cent. and California mixture, 1 part 20° Bé. to 3 parts water, against *Lepidosaphes ulmi*, L., and *Aspidiotus ostreaeformis*, Curt., showed the California mixture solution to be superior.

Acarina. *Bryobia ribis*, Thom., occurred on gooseberry, *Eriophyes pyri*, Nal., on pear, and *E. ribis*, Nal., on blackberry, while *Tetranychus* spp. infested various plants. *Taxus baccata* was attacked by *E. psilaspis*, Nal.; the collection and burning of infested buds is the only measure promising success, though, where only a very few plants are attacked, it is best to remove them bodily.

Myriapoda. *Blaniulus guttulatus*, Gerv., caused much injury to strawberries, especially in warm, wet weather. To control it, as little stable manure as possible should be used in cultivation and unslaked quicklime may be dug in superficially and the beds then watered.

No Reino das Formigas Cuyabanas. [The Position regarding *Prenolepis fulva*, Mayr.]—*Chacaras e Quintaes, Rio de Janeiro*, xv, no. 2, 15th February 1917, pp. 148–150, 3 figs.

Against the leaf-cutting ant, *Atta sexdens*, L., which is a serious pest in Brazil, use has been made of *Prenolepis fulva*, Mayr, as a means of controlling it, and the breeding of this ant has been instituted on commercial lines for this purpose. Dr. Costa Lima has, however, pointed out that *P. fulva* feeds on sugary substances and protects Aphids, so that other, more certain and less dangerous means of combating *A. sexdens* should be employed.

Bordas (M. L.). **Sur le Rôle des Ichneumonides dans la Lutte contre les Parasites des Arbres forestiers.** [On the Part played by Ichneumonids in the Control of Pests of Forest-trees.]—*C. R. hebdom. Séances Acad. Sciences, Paris*, clxiv, no. 5, 29th January 1917, pp. 235–238.

Observations analagous to those on the work of *Pimpla investigator* in parasitising many destructive larvae, including those of *Cnethocampa processionea* and *C. pinivora*, have been made concerning *Pimpla rufata*, Gm., which parasitises the larvae and pupae of *Tortrix viridana*, L.

During the last three years certain oak forests in western France have been devastated by larvae of *T. viridana*. The majority of the larvae from these forests were found to be parasitised mainly by Ichneumons, of which the chief was *P. rufata*.

Hardy (G. H.). **A new Gall-making Thrips.**—*Papers and Proc. Roy. Soc. Tasmania for the Year 1915, Hobart*, 24th February 1916, pp. 102–103.

Kladothrips rodwayi, sp. n., is described from galls on *Acacia melanoxylon*. These galls are similar to those made by *K. rugosus*, both larvae and imagines inhabiting the same gall.

Senior White (R.). **Insect Pests.**—*Trop. Agric., Peradeniya*, xlviii, no. 2, February 1917, pp. 115–121.

This paper gives some notes on Lepidopterous pests of certain food-crops. Onions are attacked by *Estigmene lactinea*, which also attacks kohl-rabi and beet, and *Phytometra* (*Plusia*) *signata*. The best method of control is hand-picking the caterpillars. Pests of brinjals (*Solanum melongena*) and other Solanaceous plants are: Sarrothripinae spp., which are best destroyed by crushing *in situ* on the leaves; these caterpillars are parasitised by a small fly which usually acts as sufficient control, but sometimes appears too late

to save the crop; *Pericallia ricini,* which also attacks beans; *Eublemma olivacea,* which can best be controlled in the pupal stage, as the cocoons are fairly easily seen; *Prodenia litura,* which appears to be omnivorous, and two other species of Lepidoptera.

Cucurbitaceous plants are infested by the larva of *Phytometra peponis* (*Plusia agramma*) and *Glyphodes indica,* both of which specially attack snake gourd.

Malvaceous plants are attacked by *Sylepta derogata* and *Anomis* (*Cosmophila*) *erosa*; leaves infested by the former should be destroyed, and to control the latter hand-picking must be resorted to.

Kohl-rabi, turnips and cabbages are all liable to infestation by *Hellula undalis* and *Plutella maculipennis,* both of which can only be controlled by spraying; *Idaea fibulata*; *Phytometra* (*Plusia*) *orichalcea* and *Crocidolomia binotalis,* which can only be controlled by hand-picking.

THEOBALD (F. V.). **Notes on New and Little Known British Aphides. III.**—*Entomologist, London,* l, no. 647, April 1917, pp. 76–82.

The Aphids dealt with in this paper include *Pemphigus borealis,* Tullgr., on lettuce roots, which probably migrates from poplars to lettuce; *Brachycolus stellariae,* Hardy, on galled leaves of *Stellaria* sp.; *Macrosiphum loti,* Theo., on *Lotus corniculatus* from various localities and also recorded by Mordwilko from Russia, being placed by him in the genus *Acyrthosiphon*; *M. rubifolium,* sp. n., described from specimens taken on blackberries (*Rubus fruticosus*) and raspberries (*R. idaeus*) in company with *Amphorophora rubi,* Kalt.; *M. euphorbiellum,* sp. n., described from specimens on spurge (*Euphorbia esula*); *Acyrthosiphon genistae,* Mordw., taken on various species of *Genista*; *Myzus festucae,* sp. n., described from specimens taken on *Festina ovina* var. *rubra,* the grass being killed owing to the number present; *Rhopalosiphum aconiti,* Van der Goot, from Yorkshire, the only other record of this species known to the author being from Holland. A colony of *Prociphilus crataegi,* Tullgr., was placed in breeding jars with rooted grasses and other plants; though the winged forms did not appear to show any inclination to migrate and young were produced by them, no trace of their descendants could be found on the roots of some fifteen species of plants.

MASI (L.). **A new Species of** *Cerapterocerus,* **Westw.** (*Eusemion,* **Dahlb.**), (**Encyrtidae: Chalcidoidea**) **from Italy.**—*Entomologists' Mthly. Mag., London,* 3rd Ser. no. 28, April 1917, p. 80.

The author now describes as a new species under the name *Eusemion italicum* an insect previously described and figured by him as *Cerapterocerus corniger,* Walk. This Chalcid has been bred from the Coccid, *Ceroplastes rusci,* in Italy.

LEFROY (H. M.). **Insecticides.**—*Gardeners' Chronicle, London,* lxi, no. 1580, 7th April 1917, p. 139.

This popular article contains formulae for useful and easily-made sprays and simple directions for their application. The use of insecticides is strongly urged on British fruit-growers, the advantage

of this procedure being proved by the high quality of the Canadian and Tasmanian fruit which is sent over to be sold in British markets, due to the thorough methods taken in those countries to prevent damage by insects.

Formulae for standard wetting mixtures are given, to any of which the particular poison required to control a specific pest may be added. These are:—a resin stock solution made by dissolving 8 lb. washing or crystal soda in 3 gals. of water in a large vessel and boiling. While boiling, 8 lb. block or lump resin roughly powdered is gradually added, and when dissolved, more water is added until the quantity is made up to 10 gals. This should be diluted with nine times its bulk of water before using. Other solutions are made by dissolving 10 lb. soft soap or 7 lb. bar or hard soap in 100 gals. of soft or rain water and diluting 1 in 10 before using.

For winter washes 1 quart creosote oil or crude disinfectant, which makes a milky mixture with water, may be added to the resin stock solution in the proportion of 1 in 40 of the oil and 1 in 16 of the disinfectant. This is an effective spray against apple suckers. For a caterpillar wash or against codling moth (*Cydia pomonella*) and weevils lead arsenate may be added to the standard wash. Sodium arsenate 1½ lb. and lead acetate or nitrate 3½ lb. should be dissolved separately in water and then mixed together and sufficient water added to make the quantity up to 30 gals. One gallon of this mixture added to one gallon of stock solution and made up to five gallons makes an effective spray. It must be well stirred before use. Potassium bichromate may be substituted for sodium arsenate and should be used in the proportion of 2½ lb. of bichromate to 5 lb. lead acetate or nitrate.

For woolly aphis (*Eriosoma lanigerum*) a very successful spray may be made by adding 1 pint of carbon tetrachloride to 3 gals. of stock solution and 1 oz. creosote oil, the whole being diluted in the proportion of 1 to 7. Methylated spirit or petrol may be substituted for the tetrachloride, but is less effective.

Red spider on gooseberries may be controlled by spraying with a mixture of 3 lb. flowers of sulphur added to 10 gals. resin stock solution, while hot, and then diluted in the proportion of 1 : 8. The stock solutions diluted with water only are the best control sprays for Aphids.

Criddle (N.). **Precipitation in Relation to Insect Prevalence and Distribution.**—*Canadian Entomologist, London, Ont.*, xlix, no. 3, March 1917, pp. 77–80.

Humidity, chiefly in the form of rain or snow, is instrumental in either aiding or curtailing the spread of insects all over Canada, particularly in the Prairie Provinces. Most insects are very dependent on the presence of moisture, especially in the larval stages. An example of insects that thrive best when moisture is least prevalent is the Rocky Mountain locust (*Melanoplus spretus*), which has caused enormous losses in past years and has invaded Manitoba on more than one occasion. It has always invaded Western Canada during a dry season, arriving in swarms in July and August. Eggs were soon deposited in vast numbers, and crops suffered in consequence much

more during the following year. Though able to breed for one or two seasons in the invaded territory, the locusts have seldom remained long, moisture, in excess of that to which they were accustomed, producing disease from which many die, the survivors migrating. The lesser migratory locust (*M. atlantis*) also becomes more numerous and destructive in dry seasons. The western wheat-stem sawfly (*Cephus* sp.) is considerably reduced under natural conditions by a dry season, but owing to the advance of agriculture and the cultivation of cereals these sawflies have been enabled to continue their increase by attacking wheat and rye, with the result that they are now a serious pest. The Hessian fly (*Mayetiola destructor*) is also largely controlled by lack of moisture.

Snow is a very important factor in preserving insect life in winter. This was shown by the effect of a lack of snow during the winter of 1914–15 in Manitoba on the Colorado potato beetle (*Leptinotarsa decemlineata*), which had been a serious pest during the previous year. In those parts, where there was only three inches of snow or less, the beetles were found dead, crowded together in their winter quarters. Where there was a depth of snow amounting to from four to six inches, the survivors were considerably more numerous. At eight inches about half the beetles survived, while a foot or more of snow apparently provided complete protection from frost.

WEISS (H. B.) & DICKERSON (E. L.). *Plagiodera versicolora*, **Laich. An imported Poplar and Willow Pest.**—*Canadian Entomologist, London, Ont.*, xlix, no, 3, March 1917, pp. 104–109, 1 plate.

Poplars as well as willows in New Jersey have been reported to be infested by *Plagiodera versicolora*, a European species. The adult beetles emerge in late April or early May after hibernation, and oviposition takes place after feeding. By early June, the adults have disappeared and the eggs have hatched. Three broods of beetles were noted during the year, the last hibernating under the loose bark, etc., and appearing as the first brood the following year. The eggs are laid in circular or oval patches and almost invariably on the underside of the leaves.

This beetle is parasitised by the Chalcids, *Coelopisthia rotundiventris*, Gir., and *Pleurotropis tarsalis*, Ashm., the former being a primary parasite and the latter probably a hyperparasite. It is also preyed upon by a bug.

CAMPBELL (D.). **Black Fly of Citrus.**—*Jl. Jamaica Agric. Soc., Kingston*, xvi, no. 2, February 1917, p. 50.

The citrus trees belonging to the author with one exception were infested with the citrus black fly (*Aleurocanthus woglumi*), and covered with the sooty mould consequent upon the secretions from the larvae of this pest. The exceptional tree was found to have a small nest of ants on it, *A. woglumi* being entirely absent from it. The experiment of putting an ants' nest on every tree was then tried with very satisfactory results.

The Pimento Scale Insect.——*Jl. Jamaica Agric. Soc.,, Kingston,* xxi, no. 2, February 1917, pp. 58–59.

This recently described scale, *Odonaspis pimentae,* Newst., causes the bark of pimento trees to become discoloured and to be ultimately shed in small irregular pieces instead of in long strips. The scales also suck the juices of the trees, so weakening them that they commence to die. In some cases it interferes with the shedding of the bark, badly infested trees being apparently unable to shed their bark at all, with the result that they become stunted and die.

Webster (P. J.). **A new Tent-frame for Plant Fumigation.**—*Philippine Agric. Rev., Manila,* ix, no, 4, Fourth Quarter 1916, pp. 354–356, 4 figs. [Received 11th April 1917.]

A description is given of a portable frame for fumigating a comparatively large number of small mango trees in the field. Working directions are given and illustrated. In order to preserve the woodwork from decay and from the attacks of termites, it is thoroughly painted with carbolineum.

Zimmer (J. T.). **Recurrence of a Coconut Pest.**—*Philippine Agric. Rev., Manila,* ix, no. 4, Fourth Quarter 1916, p. 367. [Received 11th April 1917.]

An outbreak of the coconut whitefly, *Aleurodicus destructor,* Quaint., was recorded from the province of Zamboanga in June 1916. Two previous outbreaks have been recorded in 1911 and in 1913.

McKay (J. W.). **Annual Report of the Karimganj Agricultural Experiment Station for the Year ending 30th June 1916.**—*Ann. Rept. Agric. Expts. and Demonstrations in Assam for the Year ending 30th June 1916, Shillong,* 1916. [Received 11th April 1917.]

This report, which contains no scientific names, records a serious plague of swarming caterpillars on rice in the seed-beds, which spread to the transplanted crop. The plague was checked by sweeping up the caterpillars and by dragging a fishing net over the crop, as well as by destroying the pupae by scraping up the earth on the ridges round the rice-fields and throwing it into the water. In September a second brood appeared, which was spread over a larger area, but was less numerous than the first and was controlled by hand-picking, by disturbing the insects by means of a rope dragged over the crop and by shaking them into water on which a little kerosene oil had been poured.

The rice bug (*Leptocorisa*) damaged some crops in September and October so badly that a great deal of the rice had to be cut down and used for fodder.

In the Annual Report of the Jorhat Agricultural Experiment station for the year ending 30th June 1916, the cane moth borer was reported as doing considerable damage to sugar-cane at Jorhat.

Paper Quills for Cutworms.—*Queensland Agric. Jl., Brisbane,* vii, no. 2, February 1917, p. 72. [Received 11th April 1917.]

A simple remedy, which has been found efficacious against cutworms destroying plants in gardens, is to wrap some thick paper round the stems of the plants just above the roots prior to putting the plant in the ground. The root is then planted with the paper about half-way in the ground. This prevents the worms from attacking the plant, as they cannot pierce the paper and cannot climb up it. By the time the plants are strong enough to resist attack, the paper will have rotted away.

Jarvis (E.). **The Cane Beetle.**—*Queensland Agric. Jl., Brisbane,* vii, no. 2, February 1917, pp. 83–84. [Received 11th April 1917.]

This paper contains notes on the egg-stage of the grey-back beetle, *Lepidiota albohirta*, Waterh. The depth at which the eggs are deposited in the soil varies according to the amount of moisture present; under normal weather conditions, this is usually about 6 inches. The eggs are deposited in a flattened mass on the floor of an irregular-shaped chamber, the sides of which are firmly compacted by the adult. One female may lay as many as 36 eggs, the average being about 20. If a spell of dry weather follows the deposition of a large batch of eggs, oviposition may cease, while under showery conditions the process may be more prolonged. Beetles which were heavily parasitised were found capable of living many days and in some cases were even able to oviposit.

Dupont (P. R.). **Insect Notes.**—*Ann. Rept. on Agric. & Crown Lands for the Year 1915, Victoria, Seychelles,* February 1916, pp. 20–22, [Received 11th April 1917.]

Coccus (*Lecanium*) *viridis* (green scale) continues to damage coffee bushes in the low country of the Island, but on the hills is kept in check by the fungus, *Cephalosporium lecanii*, which has also attacked *Eucalymnatus* (*L.*) *tessellatus* on cinnamon and coconuts. *Chrysomphalus aonidum* (*Aspidiotus ficus*) severely damages young coconut plants. A few minute parasites have been reared from this insect and are being identified.

The following boring and grain beetles are recorded: Scolytids: *Xyleborus perforans*, Woll., caused serious damage to coconuts, very few of the trees attacked yielding any nuts. *X. semigranosus*, Blandf., is a secondary pest of cinnamon, *Albizzia lebbek* and *Eugenia jambos.* Cinnamon bushes peeled for their bark are attacked a few days after they are cut down, even at a distance of several miles from infested localities. *X. abruptus*, Samps., is known only from Seychelles, where it is very common on cashew (*Anacardia*), *Albizzia lebbek* and *E. jambos. Crossotarsus externedentatus*, Fairm., attacks *Pterocarpus indicus* when the branches have been cut down, as well as newly cut stems, twigs and boughs of *Ficus nautarum.* The adult insect works its way inward from the underside of the bough lying on the ground in a damp place, the eggs being laid in clusters and many larvae being found close to the pith of the wood. Branches left on a boulder and exposed to the sun are not attacked.

Dinoderus bifoveolatus, Woll., attackes all bamboos except the giant bamboo; it is also a grain beetle and attacks flour. The Tenebrionid, *Rhizopertha dominica*, F., and *Tribolium castaneum*, Hbst., attack lentils; *Calandra oryzae* attacks rice and maize; *Diocalandra frumenti*, F. (*Calandra stigmaticollis*, Gyll.) occurs on green coconut stems. No control has yet been attempted of these grain beetles, but treatment by carbon bisulphide has been advised. A list of the scale-insects occurring in the Island is given [see this *Review*, Ser. A, v, p. 4].

GIBSON (H.). **Spraying in the Home Garden.**—*Canadian Horticulturist and Beekeeper, Toronto*, xxv, no. 3, March 1917, pp. 73–74, 1 fig.

This article gives instructions in a popular form for spraying against insects pests most commonly met with in gardens and orchards, such as San José scale [*Aspidiotus perniciosus*], oyster-shell scale [*Lepidosaphes ulmi*], codling moth [*Cydia pomonella*], Aphids, and tent caterpillars [*Malacosoma*].

WALTON (W. R.). **Grasshopper Control in Relation to Cereal and Forage Crops.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 747, October 1916, 20 pp., 21 figs. [Received 12th April 1917.]

The grasshoppers dealt with in this bulletin include *Melanoplus differentialis*, Thom.; *M. bivittatus*, Say; *M. atlantis*, Riley; *M. femur-rubrum*, De G.; *M. devastator*, Scudd.; *Dissosteira carolina*, L.; *D. longipennis*, Thom.; *Camnula pellucida*, Scudd.; *Brachystola magna*, Gir.; and *Dictyophorus reticulatus*, Thunb. Insect enemies of these species include the fly, *Sarcophaga kellyi*, which deposits living maggots on the wings of the grasshoppers while they are in flight. The robber fly, *Promachus vertebratus*, attacks the adult grasshoppers, and the digger wasp, *Priononyx atratus*, provisions its nest with them. Certain blister beetles attack the eggs of grasshoppers, but are themselves injurious insects. Wild birds play quite an important part in the natural control of grasshoppers.

Control measures include destruction of the eggs, trapping the insects and poisoning them with bait. The eggs are often very difficult of access, but where practicable, ploughing, disking and harrowing in autumn prevent the eggs from hatching in the spring. The most usual form of mechanical trap is the hopperdozer, of which two different models are described in this bulletin. The most effectual control yet devised is a poison-bait, consisting of poisoned bran-mash or a modified Criddle mixture. In semi-arid climates the baits should be applied during the late afternoon, before the insects ascend the plants for the night, and should be used with additional moisture. In moist climates the early morning is the best time for application.

NEWCOMER (E. J.). **The Dock False-worm: an Apple Pest.**—*U.S. Dept. Agric., Washington, D.C.*, Bulletin 265, 29th December 1916, 40 pp., 6 figs., 25 tables. [Received 12th April 1917.]

The dock false-worm, the larva of the sawfly *Taxonus* (*Ametastegia*) *glabratus*, Fall., which is found all over Europe and in Canada and the

northern part of the United States, from the Atlantic to the Pacific, feeds naturally upon plants belonging to the buckwheat family including the numerous docks and sorrels (*Rumex*) and the knotweeds and bindweeds or wild buckwheat (*Polygonum*) and others. This insect becomes of economic importance when, under certain conditions, it finds its way at maturity into apple trees, where it bores into the fruit to hibernate, rendering it unsaleable. It can however only find its way into such orchards as are not kept cleanly cultivated. The possiblity of the larvae reaching orchards from neighbouring meadows, ditch-banks, or road-sides is slight, as they are incapable of finding their way over any extent of bare uncultivated soil. The risk of larvae adapting themselves to the apple is unimportant, as apple foliage is so much tougher and drier than the succulent foliage of the normal food-plants. When the larvae do obtain access to the apples, the injury done is as great as that which caused by the codling moth [*Cydia pomonella*], as a single larva will often bore several holes in a single apple, and sometimes in several, before forming its final burrow. This burrow is often larger than that made by the codling moth larva and is confined to the flesh of the apple. Though not, as yet, a serious pest, it is quite conceivable that it might become so under favourable conditions

A detailed account of the life-history and habits of *T. glabratus* is given. There are four generations annually, each occupying about a month, except the fourth, the larvae of which hibernate and complete their development the following spring. Only the larvae of this last generation are known to bore into apples.

This sawfly is parasitised by the Ichneumonids, *Epiurus pterophorae*, Ashm., *Spilocryptus* sp., *Aenoplex* sp., *Bathymetis* sp., *Bathyrix* sp., and two species of *Cratocryptus*, attacking the larvae; the Chalcid, *Trichogramma minutum*, Ril., attacking the eggs; and the Braconid, *Rhysipolis* sp. It is preyed upon by two Chrysopid larvae and probably by Coccinellid larvae also.

Apples may be protected from this insect by keeping orchards free of docks and other food-plants, or, when this is not possible, by banding the trees with cotton or some adhesive substance that will not damage the trees in the latter part of August and leaving the band on until the fruit is harvested.

McGregor (E. A.) & McDonough (F. L.). **The Red Spider on Cotton.** —*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 416, 29th January 1917, 72 pp., 8 plates, 21 figs. [Received 12th April 1917.]

This bulletin is an amplification of previous papers [see this *Review*, Ser. A, iii, p. 63, iv, p. 511]. The classification and synonymy of *Tetranychus telarius*, L. (*bimaculatus*, Harvey), are given, with details of its distribution, food-plants and life-history. The nature and extent of the injury to cotton in the southern States and the methods of dispersion and influence of climate are also discussed.

The list of insect enemies of the red spider is now a considerable one and includes:—

Acarina. The Gamasids, *Seius quadripilis*, Bks., *Macrochelis* sp., and *Laelaps macropilis*, Bks., are all important enemies. *Rhyncholophus*

pilosus, Bks., destroys red spider on *Lechea villosa* and on Boston ivy, and the mite, *Anystis agilis*, Bks., has been collected on infested elderberry and violets.

Thysanoptera. *Scolothrips sexmaculatus*, Perg., is a voracious feeder on red spider, particularly in the egg-stage, and is itself destroyed by *Triphleps insidiosus*. *Euthrips fuscus*, Hinds, and *E. occidentalis*, Perg., have also been collected in red-spider colonies and are believed to be predatory on the mites.

Rhynchota. The Anthocorids, *Triphleps insidiosus*, Say, and *T. tristicolor* destroy red spider; they pass the winter in the adult stage and usually become active some time in April; they are at their maximum in July, hibernating in October. The Lygaeid, *Geocoris punctipes*, Say, the life-history of which is given in a table, deposits eggs in the midst of red-spider colonies on cotton leaves, the newly-hatched nymphs readily devouring both spiders and eggs. This bug is parasitised by the Scelionid, *Telenomus* sp. A nymph of the Capsid, *Rhinacloa forticornis*, Reut., was observed in red-spider colonies in a cotton field feeding on the mites, and in a rearing cell ate on an average 60 mites a day. A Reduviid bug occurs abundantly both in the nymphal and egg stages in red-spider colonies on tomato leaves and a nymph placed in a breeding cell destroyed an average of 12 spiders a day.

Neuropterous enemies include *Chrysopa rufilabris*, Bks., the life-history of which is given in tables; this species exerts a marked control over red spider during August. It is itself parasitised, sometimes to the extent of 55 per cent., by various enemies, including *Chrysopophagus compressicornis*, Ashm., *Perilampus chrysopae*, Crawf., *Geniocerus chrysopae*, Crawf., *Isodromus iceryae*, How., *Orthizema atriceps*, Ashm., and *Heloris* sp. *Telenomus chrysopae*, Ashm., was reared from an egg. Other Chrysopid enemies are *Chrysopa quadripunctata*, Burm., *C. oculata*, Say, and *C. nigricornis*, Burm.

Dipterous parasites include the Cecidomyid, *Arthrocnodax carolina*, which destroys red-spider eggs in large quantities during August and September. Tables dealing with its life-history are given. It is itself parasitised by the Chalcidid, *Aphanogmus floridanus*, Ashm. Another predaceous Cecidomyid is *Mycodiplosis macgregori*, Felt, which greatly resembles *A. carolina*, but appears somewhat later. Syrphid flies are incidental enemies of red spider, the species most commonly found among the mites being *Baccha clavata*, F., *Allograpta obliqua*, Say, *Sphaerophoria cylindrica*, Say, and *Toxomerus duplicatus*, Wied. Enemies of these Syrphids are: *Chrysopophagus compressicornis*, Ashm., *Pachyneuron allograptae*, Ashm., *Syrphophagus mesograptae*, Ashm., *Tetrastichus* sp. and *Diplazon laetatorius*, F.

Among Coleoptera, the Coccinellids, *Pentilia* sp., *Stethorus punctum*, Lec., *S. nanus*, Lec., *S. marginicollis*, Mann., are all predaceous enemies, *S. punctum* being sometimes so abundant as to exterminate colonies of red-spider. *S. utilis*, Horn, is a voracious feeder on the red-spider on cotton. The life-history of this species is given in the form of a table. *Stethorus picipes*, *Scymnus collaris*, Melsh., *Microweisea misella*, Lec., *Megilla maculata*, De G., *Hippodamia convergens*, Guér., and *Coccinella novemnotata*, Hbst., have all been recorded as assisting in the control of red-spider.

Among Lepidoptera, the Noctuid, *Alabama argillacea*, Hb., acts indirectly as a control; when this species becomes abundant on cotton in late September or October, the caterpillars devour every vestige of cotton foliage, eating the red spiders together with the leaf-tissue, while those that are not actually devoured at the time of defoliation are compelled to seek new hosts by migrating.

Tables are given recording the rates of feeding of the principal enemies mentioned.

Preventive measures include clean culture, and the extermination of winter hosts and of all weeds and plants on which the pest feeds. Violets especially, when grown near cotton, should be watched and sprayed or destroyed if found to be infested. A finely pulverised surface mulch maintained on the fields may retard the migration of the mites and so limit the infestation. Trap-crops, rotation, irrigation, etc., have been proved to be of slight or negative value. The following insecticide sprays have all been used with successful results: Potassium sulphide, 1 oz. to 2 U.S. gals. water; kerosene emulsion, 2 gals. kerosene to 12 gals. water; lime-sulphur (home-made and commercial); commercial misicible oil in a strength of 1 : 20; water-soluble oil; resin wash, consisting of 2 lb. resin, $\frac{1}{2}$ lb. caustic soda, $\frac{1}{4}$ pint U.S. fish-oil to 10 U.S. gals. water. This is an excellent spray for red spider, but is not prepared quickly or easily. Nicotine sulphate $\frac{1}{2}$ oz., to $\frac{1}{4}$ lb. fish-oil soap with 2 U.S. gals. water was found a perfect spray, and nicotine sulphate (1 to 500) and a miscible oil (1 to 40) also caused complete mortality. A simple adhesive spray made of laundry starch converted into paste and diluted with water deserves further consideration. Fish-oil soap, $\frac{1}{4}$ lb. to 2 U.S. gals. water also caused complete mortality. In spraying, it is necessary to hit the entire underside of every leaf of an infested plant, and, since none of the above sprays destroys the eggs, a second spray is essential to kill the individuals that were in the egg-stage at the time of the first spraying.

A bibliography of 91 works is given.

Sasscer (E. R.). **Fumigation of Ornamental Greenhouse Plants with Hydrocyanic-acid Gas.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 513, 10th March 1917, 20 pp., 4 figs.

This paper gives detailed directions for fumigation with hydrocyanic-acid gas. A table is given of the greenhouse plants which are most easily injured by the gas, the pests controlled, and the quantity of gas per 1,000 ft. which can be used without causing any damage to plants. For each ounce of sodium cyanide, $1\frac{1}{2}$ U.S. fluid oz. of sulphuric acid should be used with 2 U.S. fluid oz. of water. The water should be measured out first into each generator, then the acid should be added and lastly the cyanide should be gently dropped into the warm water immediately before leaving and closing the greenhouse. A short exposure lasting one or two hours with a more concentrated gas has been found more satisfactory than a weaker gas used throughout the night. The effects of weather conditions on fumigation are discussed. The temperature should be between 55° and 70° F. Fumigation during sunshine is liable to cause injury to the plants. Excessive moisture in the greenhouse decreases the effectiveness of the gas, owing to its

ready solubility in water. A high degree of humidity, such as 98 to 100, does not cause injury unless accompanied by a temperature exceeding 70° F.

COTTON (R. T.). **Scale Insects and their Control.**—*Bd. Commiss. Agric., Rio Piedras Expt. Sta., San Juan, P.R.*, Circular no. 9, 1917, 7 pp. [Received 12th April 1917.]

This popular article on the scale-insects of Porto Rico contains little new information. The most successful spray used on the island for these pests is kerosene emulsion, 1 part to 15 parts water. For citrus scales an emulsion is recommended composed of 8 lb. or 1 U.S. gal. whale-oil soap, 2 U.S. gals. corvus or red junior oil, 1 U.S. gal. water. Two or three weeks after application, the dead scales should be scrubbed off the trunks. For pineapple mealy-bug [*Pseudococcus bromeliae*] the following emulsion is recommended: 2 U.S. gals. kerosene oil, ½ lb. blue cloud soap or caustic potash soap, 1 U.S. gal. water. One part of this emulsion should be used to 18 parts water. This should not be used on the newly formed fruit buds and must be applied with a fine spray powerful enough to remove the mealy coat of the insects and saturate them with the spray.

FAULWETTER (R. C.). **Dissemination of the Angular Leafspot of Cotton.**—*Jl. Agric. Research, Washington, D.C.*, viii, no. 12, 19th March 1917, pp. 457–475, 2 figs.

In connection with the dissemination of angular leaf spot of cotton, caused by *Bacterium malvacearum*, investigations have been made to determine the rôle played by insects in the spread of this disease. As Jassids were the most common and most active insects on the cotton plants under investigation, these insects were chosen for the experiments, and tables are given showing the results of treating plants infested by them with cultures of *B. malvacearum.* While the data are not conclusive, the results of the tests lead to the conclusion that insects have a very slight, if any, effect in dissemination of the disease, and this is borne out by later observations in the open field.

A bibliography of 40 references is appended.

MORRISON (H.). **Monograph of the Nearctic Hymenoptera of the Genus** *Bracon* **Fabricius.**—Separate, dated 7th March 1917, from *Proc. U.S. Nat. Mus., Washington*, lii, pp. 305–343, 4 plates.

A key is given to the species of this genus, which are described. *Bracon vulgaris*, Cress., is the only species for which there are breeding and host records, this species having being recorded as a parasite of the sugar-beet web-worm, *Phlyctaenodes* (*Loxostege*) *sticticalis*, L.

EHRHORN (E. M.). **Division of Plant Inspection.**—*Hawaiian Forester and Agriculturist, Honolulu*, xiv, no. 1, January 1917, pp. 8–10. [Received 12th April 1917.]

During the month of December 1916, a pine tree infested with a species of *Chermes* was fumigated before delivery. A nest of ants, *Prenolepis longicornis*, was found in packing material in a box from Japan; the box was fumigated with carbon bisulphide for 48 hours,

after which all the ants were found to be dead. Several palms from California were fumigated against mealy bug [*Pseudococcus*]. Two cases of beneficial insects arrived for the Hawaiian Sugar Planters' Association experiment station.

FULLAWAY (D. T.). **Division of Entomology.**—*Hawaiian Forester & Agriculturist, Honolulu,* xiv, no. 1, January 1917, p. 11. [Received 12th April 1917.]

During the month of December the insectary handled 57,600 pupae of the melon fly [*Dacus cucurbitae*], from which 1,900 females and 1,558 males of *Opius fletcheri* were bred and distributed.

The corn leaf-hopper parasites have now become established at the U.S. Experiment Station.

DU PORTE (E. M.) & VANDERLECK (J.). **Studies on** *Coccobacillus acridiorum*, **d'Hérelle, and on certain Intestinal Organisms of Locusts.** —*Annals Entom. Soc. America, Columbus, Ohio,* x, no. 1, pp. 47–62, 7 tables.

These experiments on the control of locusts by the use of *Coccobacillus acridiorum* were made with the object of ascertaining the value of this method under the conditions obtaining in Eastern Canada.

The culture used was obtained from the Pasteur Institute in Paris, and its virulence increased by passage through 12 lots of locusts. After the twelfth passage, it was found that the maximum virulence was reached. This increase of virulence is shown in tabular form, as well as the greater virulence of the intestinal contents of locusts which die late as compared with those from the same lot which die earlier.

The species experimented upon included :—*Melanoplus femur-rubrum*, *M. bivittatus*, *M. atlantis*, *Dissosteira carolina*, *Camnula pellucida*, *Stenobothrus curtipennis* and *Xiphidium* sp., which all proved susceptible to *C. acridiorum*, as also were *Gryllus pennsylvanicus* and some examples of *Nemobius* spp. The yellow bear caterpillar (*Spilosoma virginica*) died after injection, but in the case of the potato beetle (*Leptinotarsa decemlineata*), the number of beetles and grubs which died after injection was not greater than those injected with distilled water. The insect and other parasites of diseased locusts were apparently not affected, as several Sarcophagid flies were reared from diseased locusts and a large number of Gordiid worms emerged from diseased or dead insects. Fowls, guinea-pigs, rabbits and man are apparently not susceptible to infection.

Experiments were carried out in the laboratory in order to discover the effect of spraying locusts with a culture of *Coccobacillus*; of these, one died at the end of 30 hours, one in 2 days, one in 3 days and two more at the end of 8 days, the remainder showing no symptoms of disease. The effect of contaminating the soil resulted in one locust out of twelve dying at the end of the first day, the rest being unaffected. When several locusts were placed in an unsterilised cage from which dead locusts had been removed, no mortality resulted among them. The effect of contaminating the food was tried on 17 nymphs, the food being renewed daily and sprayed with either a pure culture of *Coccobacillus* or a suspension of the intestines of dead locusts. There

were no deaths until the fifth day, when one nymph died, a few other deaths occurring at intervals. *C. acridiorum* was found in the intestines of some of the locusts at the end of three weeks, when the experiment was discontinued. Twenty locusts were fed on sweetened bran-mash to which a culture of *Coccobacillus* had been added, with the result that two died at the end of the first day, twelve were dead by the 7th day and 15 on the 11th day. The remainder lived for 8 more days after being removed to a clean cage. Experiments were tried on specimens of *M. femur-rubrum* and a few examples of other species in order to test whether the disease would spread rapidly from dead or diseased individuals to healthy ones, but yielded no result. It was found that *M. bivittatus* would feed on the dead insects, so a further experiment was made with equal numbers of these two species placed with dead locusts to test the effect of this cannibalistic tendency on the spread of the disease. At the end of 8 days 80 per cent. of *M. bivittatus* were dead, but only 20 per cent. of *M. femur-rubrum.* No difference was observed in the relative resistance between male and female locusts, but nymphs were apparently more resistant than adults, and no greater susceptibility was manifested by *M. femur-rubrum, M. bivittatus, D. carolina* and *S. curtipennis* over any of the others. It therefore appears that all common injurious locusts and grasshoppers in Eastern Canada are equally susceptible to this disease and that *C. acridiorum* is pathogenic to them all.

Field experiments on these lines were also made, but without very satisfactory results. The conclusion is therefore reached that under Eastern Canadian conditions d'Herelle's biological method for the control of locusts is not suitable. Should the disease become established its spread would be extremely slow owing to the non-migratory and non-cannibalistic tendencies of the native species. The presence of several native strains of a *Coccobacillus* identical with or closely related to *C. acridiorum* probably renders the locusts immune to a mild infection of this virus.

The second part of this paper deals with descriptive studies of *C. acridiorum* and sixteen related native organisms.

A bibliography of twelve volumes is appended.

Marchal (P.). **La Fourmi de l'Argentine** (*Iridomyrmex humilis*, **Mayr**). [The Argentine Ant (*Iridomyrmex humilis*, Mayr)].—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, nos. 1–2 & 3–4, January-February & March-April 1917, pp. 1–6 & 23–26, 3 figs.

This paper is an extract from the author's account of his travels in the United States [see this *Review*, Ser. A, iv, p. 488], dealing with Newell and Barber's work in connection with the Argentine Ant, *Iridomyrmex humilis*, Mayr [see this *Review*, Ser. A, i, p. 325].

de Joannis (J.). **Chenilles de** *Lyonetia clerkella*, **L. (Lep.) minant les feuilles de** *Prunus laurocerasus*. [Caterpillars of *Lyonetia clerkella*, L. mining the leaves of *Prunus laurocerasus*.]—*Bull. Soc. Entom. France, Paris*, no. 3, 1917, p. 85.

A large number of caterpillars of *Lyonetia clerkella* were found mining the leaves of *Prunus laurocerasus* in Morbihan. This is believed to be the first time that this fact has been recorded.

Paillot (M. A.). **Microbes nouveaux parasites des chenilles de** *Lymantria dispar.* [New parasitic Microbes of the Caterpillars of *Lymantria dispar.*]—*C.R. hebdom. Séances Acad. Sciences, Paris,* clxiv, no. 13, 26th March 1917, pp. 525–527.

The microbes parasitic in the larvae of *Lymantria dispar* here described are a *Coccobacillus* provisionally identified as *Bacillus lymantriae, Diplococcus lymantriae,* sp. n., which is only slightly pathogenic to the caterpillars, and *Bacillus liparis,* sp. n., which resembles the diptheria bacillus and is more pathogenic to the larvae of *L. dispar* than *Diplococcus lymantriae.*

Font (J.). **Telaraña de los Alfalfares.** [Spider-webs on Lucerne.] —*Gaceta Rural, Buenos Aires,* x, no. 116, March 1917, pp. 463–464.

The small spider, *Theridium weyeberghii,* Holm., has been found to cause considerable damage to lucerne plants by weaving a thick web over them. The spider works with great rapidity, covering many yards of lucerne with its web in a few hours. The web can be removed by lightly sweeping over the crops with branches of trees, to which the webs will cling, but the spiders should be destroyed by spraying with a very fine spray, using one of the following insecticides : ½ lb. lysol to 25 gals. water ; 2 parts acaroina to 100 parts water ; 3 parts kerosene to 100 parts water ; 8 lb. tobacco juice to 20 gals. water.

Insect Pests in the Argentine.—*Bol. Minis. Agric., Buenos Aires,* xx, nos. 9–12. September-December 1916, pp. 707–708. [Received 11th April 1917.]

During the month of October 1916, 1,425,864 lb. of locusts, 9,275 ants' nests and 34,025 lb. of bagworms were destroyed. The inspection of plants for *Aulacaspis pentagona* showed 9,903 infested plants.

Mercet (R. G.). **Especies españolas del genero** *Aphycus.* [Spanish Species of the Genus *Aphycus.*]—*Bol. Real. Soc. Española Hist. Nat., Madrid,* xvii, no. 2, February 1917, pp. 128–139, 6 figs. [Received 11th April 1917.]

These notes form part of a work on the Encyrtidae of Spain which will be published by the Instituto Nacional de Ciencias Fisico-Naturales.

The following species of *Aphycus* are described :—*A. hesperidum,* Mercet, parasitising *Chrysomphalus dictyospermi,* var. *pinnulifera* on orange, laurel and oleander ; *A. hederaceus,* Westw., a common parasite of *Aspidiotus hederae* on *Hedera helix* ; *A. pinicola,* sp. n., found on the leaves of *Pinus halepensis,* abundantly infested with *Chionaspis pinifoliae* ; *Aphycus* (*Metaphycus*) *zebratus,* sp. n., only found on one occasion on *Robinia pseudacacia.*

Reports on the State of the Crops in each Province of Spain on the 24th March 1917.—*Bol. Agric. Técnica y Económica, Madrid,* ix, no. 99, March 1917, p. 259.

Phloeothrips oleae continues to attack olive trees in Valencia, especially those adjacent to uncultivated lands and in the interior of the

province. A systematic fumigation with hydrocyanic acid gas is being carried out under the direction of the provincial council, to be followed by a spraying with lead arsenate for all those trees which cannot conveniently be fumigated.

Romanovsky-Romanko (A.). **Уходъ за фруктовымъ садомъ.** [The Treatment of an Orchard.]—**« Вѣстникъ Садоводства, Плодоводства и Огородничества.»** [*Messenger of Gardening, Fruit-Growing & Market-Gardening*], *Petrograd*, lvi & lvii, nos 11–12, November-December 1915 and 1–2, 3–4, 5–6, 7–8 & 9–10, January-February, March-April, May-June, July-August and September-October 1916, pp. 748–775, 63–88, 173–210, 313–327, 364–372, 501–513.

This series of articles describes work required for the care of an orchard in the different months of the year. Owing to the great differences in the climate in various parts of Russia, the information given is strictly applicable only to the central region, i.e., that between the Volga and the Dnieper ; in all other parts the different measures will have to be undertaken earlier or later, according to the latitude. The work in November and December consists of lime-washing the trunks of fruit trees, preceded by careful cleaning. To increase its disinfectant properties, about $1\frac{1}{2}$ lb. of iron sulphate is added to each gallon of lime solution. Instead of lime-washing with a brush, spraying with milk of lime or with 15 per cent. lysol may be effected, the latter being essential for the control of eggs of scale-insects, which are not affected by ordinary lime. Young apple or pear trees must be carefully searched for eggs of the apple aphis [*Aphis pomi*], which also oviposits on sorb trees, medlars and—in the south—on quinces, *Amelanchier* and dog-wood ; the eggs turn black some time after their deposition and their presence is also indicated by the black, curled leaves which remain at the end of young infested shoots. These eggs should be picked or crushed by hand, or they may be destroyed by spraying with lysol, when there is no frost. This spray is effective against eggs of *Psylla*, which can also be controlled with a solution of iron sulphate ($\frac{1}{2}$ lb. of rye flour paste being mixed with 1 lb. of iron sulphate dissolved in hot water and the whole being dissolved in 3 gallons of water or more, so as to ensure the free passage of the liquid through the nozzle of the sprayer). Besides destroying the wintering nests of *Aporia crataegi* and *Euproctis chrysorrhoea* and the egg-masses of *Malacosoma neustria*, attention must be paid in November to branches infested with Scolytids ; these should be cut away or smeared with carbolineum and lime (2 or 3 parts by volume of 3 per cent. milk of lime and 1 part of carbolineum) or with carbolic emulsion. In February observations may be begun so as to form an estimate of the probable appearance of insect pests. For this purpose the method suggested by Balabanov is recommended. By this method, branches are cut from the trees at the end of February and placed in water in a heated room ; after from 30 to 40 days, it will be possible to note the development of the buds and the appearance of various insect pests, which may have been present on them as eggs or larvae. During March the trees should be sprayed with 1 part of lime and 2 parts of washed clay dissolved in sufficient water to render the solution more or less liquid, $\frac{1}{2}$ lb. of Paris Green being added to each 30 gallons of

this, as a protection against various weevils and also against *Cheimatobia brumata* and *Eucosma ocellana*. In March the removal and destruction of eggs of the gipsy moth [*Lymantria dispar*] must be completed. In April special attention must be paid to *Cydia pomonella* and *Cydia* (*Grapholitha*) *funebrana*, which can be best combated by spraying the trees before the opening of the flower buds with Bordeaux mixture (4 lb. of lime and 4 lb. of sulphate of copper in about 60 gallons of water), repeating this later with a weaker solution (3 lb. each of lime and sulphate in the same amount of water). In the absence of sulphate of copper, lime-sulphur may be used. The month of April is also the most suitable for the control of *Zeuzera pyrina* by means of carbon bisulphide or benzine, injected into the galleries, before the caterpillars have begun to make further borings after hibernation. In May, spraying the flowering trees with water, followed by powdering with tobacco, is recommended against attacks of *Epicometis* (*Tropinota*), as the tobacco will then remain on the flowers during the whole period of blossoming. Bait-posts of poplar wood have been successfully used against cockchafer larvae in the plantations along the Central Asian Railway by V. A. Paletzky, as it has been observed that these larvae collect in great numbers round the roots of poplar trees; the posts are 6 or 7 inches in diameter and 10 inches long and are placed in the ground about 7 feet apart. They are periodically taken up and the larvae that collect underneath them destroyed. Instead of separate sprays against *Cydia pomonella* and other insects and fungi, combined sprayings have been recently utilised consisting of Bordeaux mixture (4lb. of sulphate of copper, 4 lb. of lime in 170 gallons of water) to which is added from 4 to 8 oz. of Paris green or about $1\frac{1}{2}$ lb. of lead arsenate. In June, when the adult cockchafers are on the wing and ovipositing, powdering the soil with naphthaline mixed with sand gives good results; about 67 lb. of naphthaline is required per acre, 1 part of naphthaline being mixed with 2 parts of sand. Spraying with various insecticides is recommended for July and in the event of serious outbreaks in late summer, these may have to be repeated in August, although as a rule no poison sprays should be used in this month. In September and October attention must be paid to *Cheimatobia brumata* and *Hibernia defoliaria*, the wingless females of which must be kept from the trees by means of adhesive belts.

OKUN (M.). **Урюковая пяденица и мѣры борьбы съ ней.** [*Biston cinerarius*, Esch., and its control.]—**«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, xi, no, 5, May 1916, pp. 411–416. [Received 10th April 1917.]

Biston cinerarius, Esch., is one of the most serious pests in in the Isfara orchards [see this *Review*, Ser. A, ii, p. 635]. The adults appear in the first half of March and the females, being wingless, must be prevented from ovipositing by means of adhesive belts. The caterpillars feed only during the day, becoming torpid at night, and they should therefore be shaken off the trees during the night or early morning. In order to prevent their return, the base of the tree-trunk should be surrounded with heaps of fine, dry sand, about 15 inches high, which they are unable to climb. They can also be checked by spraying with Paris green or lead arsenate. The mature

caterpillars pupate in the earth, within a radius of about 15 inches round the base of the trunk, and may be destroyed by hoeing the soil in these spots.

AKIMOV (A.). **Способъ огражденія садовъ и питомниковъ отъ личинокъ хруща.** [A Method for protecting Orchards and Nurseries from the Larvae of Cockchafers.]—**«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, xi, no. 5, May 1916, pp. 441–443. [Received 10th April 1917.]

While removing trees in the environs of Askhabad in 1911, the author observed that larvae of cockchafers collect among the rotten roots of the silver poplar (*Populus hybrida*). He therefore made experiments to find out whether, in the presence of these trees, the larvae would leave untouched the roots of others. In the spring of 1912 he therefore placed in the soil in a vertical position pieces of poplar about 14 inches long; in the following spring enormous numbers of the larvae were collected under these, while some roses near by were quite uninjured. Experiments repeated during the three following years confirmed the fact that cockchafer larvae prefer poplar trees to any other and this method has been adopted with success when planting some 50 fruit-trees in the nursery of Askhabad. A note by the Editor of this Journal regrets that the species of cockchafer tested is not given; it is, however, stated not to have been *Melolontha melolontha* (*vulgaris*).

Біологическій методъ борьбы съ саранчей. [The Biological Method of controlling Locusts.]—**«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, xi, no. 6, June 1916, pp. 573–576. [Received 10th April 1917.]

A sum of £750 was assigned in April 1916 by the Local Authority of Turkestan to enable Mr. A. V. Gratchev, Assistant Director of the Turkestan Agricultural Station, to organise experiments on the control of locusts by means of *Coccobacillus acridiorum*; the work will be carried out at the Entomological Station of Turkestan.

P. S. **Непарный шелкопрядъ въ Аулieата.** [The Gipsy Moth in Aulieata.]—**«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, xi, no. 6, June 1916, pp. 584–585. [Received 10th April 1917.]

Large outbreaks of the gipsy moth [*Lymantria dispar*] occurred during 1915 and 1916 in Aulieata and it is expected that this will be the case again in 1917, as, in the absence of any artificial means of control, it takes three years for the natural parasites of this pest to check its development.

ILIUCHIN (N.). **Дѣятельность старшаго инструктора по садоводству въ Самаркандской Области въ 1914 г.** [The Work of the Chief Instructor in Horticulture in the Province of Samarkand in 1914.]—**«Туркестанское Сельское Хозяйство.»** —[*Agriculture of Turkestan*], *Tashkent*, xi, no. 7, July 1916, pp. 620/619. [Received 10th April 1917.]

The chief orchard pests in the year under report were species of *Coleophora* and the codling moth [*Cydia pomonella*], the former

being the more harmful, injuring the trees by defoliating them, as well as destroying the fruit. Spraying with California mixture before the leaves unfold gave excellent results. Aphids were controlled by spraying with soap quassia emulsion (2 lb. of quassia, 3 lb. of soft soap in about 18 gallons of water). A species of *Epicauta* destroyed whole fields of potatoes and lucerne in some localities.

Саранча въ текущемъ году въ Сыръ-Дарьянской Области. [Locusts in the Syr-Darya Province in the current Year.]—**«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, xi, nos. 7 & 11–12, July & November-December 1916, pp. 643–651 & 945–963. [Received 10th April 1917.]

These are the minutes of a meeting of the Turkestan Agricultural Society, held on 8th June 1916, to consider measures against an outbreak of *Dociostaurus* (*Stauronotus*) *maroccanus.* After 1911, when the previous outbreak of this locust was finally checked, no damage was done by it until 1916, when it reappeared in large numbers and seriously threatened the cotton crops among others.

The entomologists present at the meeting pointed out the impossibility of completely exterminating locusts in the province, owing to the presence of mountains and of large grass areas scattered over immense steppes and other places inaccessible to man, providing favourable breeding grounds. The absence of a permanent organisation dealing exclusively with the destruction of locusts, even in years when the danger is small, also aggravates the difficulties of the situation.

The meeting finally passed a series of resolutions, which were submitted to the Ministry of Agriculture and which call for the creation of a permanent independent organisation for the control of locusts in Turkestan, at the head of which should be placed an officer with wide powers and an adequate staff of assistants. In order to safeguard the permanence of this organisation, it should be created a statutory body by act of Parliament. The Entomological Station should be relieved of the many onerous duties connected with the actual campaign.

Gijitzky (V.). **Саранчевая кампанія текущаго года и мѣропріятія на текущій годъ.** [The Locust-campaign in this Year and the Measures for the next one.]—**« Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, xi, no. 8, August 1916, pp. 716–723.

The author has been in charge of the campaign against locusts, *Dociostaurus* (*Stauronotus*) *maroccanus* and *Locusta migratoria*, in part of Tashkent, where as many as 10,800 acres were infested with the egg-clusters; the cost of these operations amounted to about £2,500. The campaign was carried on by various methods, including spraying with Paris green, locusticide and sodium arsenite, the last two proving the more effective; with poisoned baits of dung, clover or bran soaked in Paris green or locusticide, the first proved more suitable and gave very good results. For various reasons, chiefly the delay in the delivery of insecticides and the inadequate carrying out of the preliminary investigation during the preceeding year, the

result obtained was incomplete, and more or less serious damage was done in some localities. In one instance the locusts attacked a young infant, eating the flesh from its fingers. The preliminary investigations in the autumn suggested that some 67,500 acres were again infested with egg-clusters in the district, but it is considered that this figure is probably exaggerated.

DVORNITCHENKO (M.). **Врагъ у воротъ! Къ новой саранчевой кампаніи.** [The Enemy at the Gates! The new Locust Campaign.]—**«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, xi, no. 11–12, November-December 1916, pp. 919–931. [Received 10th April 1917.]

In an outbreak of locusts in the Starvation Desert in 1916, the principal species represented was *Dociostaurus* (*Stauronotus*) *maroccanus*, though a number of other species were also present, including *Orthacanthacris* (*Acridium*) *aegyptius*, L., *Oedaleus nigrofasciatus*, DeG., *Dociostaurus* (*Stauronotus*) *kraussi*, Ingen., *Calliptamus italicus*, L., and others. The chief damage was done to lucerne fields and in the presence of this crop the locusts, especially *D. maroccanus*, did not touch cotton. They also devoured castor-oil seedlings, though not the older plants, and it was stated that the locusts perished, but this was not definitely proved to be the case.

JUJUKIN (A.). **Нужно охранять фазана отъ истребленія.** [Pheasants must be protected from Destruction.]—**«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, xii, no. 11–12, November-December 1916, pp. 931–935.

The protection of pheasants from extermination by creating sanctuaries for them in the forests is advocated on the ground that these birds are useful in destroying various noxious insect larvae in the soil.

KRASSILSTCHIK (I. M.). **О борьбѣ съ амбарнымъ долгоносикомъ.** [On the Control of *Calandra granaria*, L.]—Published by the Bio-Entomological Station of the Zemstvo of Bessarabia. *Kishinev*, 1915, 20 pp. [Received 10th April 1917.]

This is a short and popular account of *Calandra granaria*, L., and its control. Special attention is drawn to the importance of the influence of moisture and temperature on this weevil. The amount of carbon bisulphide required for its destruction is about $1\frac{1}{2}$ lb. for each 350 cubic feet, this proportion being harmless to the grain, whether it is intended for food or seed; a higher proportion, although not affecting it as food, may reduce its germinating capacity from 5 to 8 per cent. Two other pests of grain, *Tinea granella*, F., and *Sitotroga cerealella*, Oliv., are also shortly dealt with.

KRASSILSTCHIK (I. M.). **Отчетъ о дѣятельности Біо-Энтомологической Станціи за 1914–1915 г.г.** [Report on the Work of the Bio-Entomological Station for Bessarabia in 1914–1915.]—*Kishinev*, 1916, 96 pp.

This report supplements the one previously issued for 1914 [see this *Review*, Ser. A, iii, p. 395]. The chief vine pests were *Clysia*

ambiguella, Hb., and *Melolontha melolontha*, L. The pupation of the larvae of *Melolontha* begins in the first half of July and is complete by the end of August; from the middle of September to the beginning of November newly emerged beetles may be found in the soil, the insects hibernating in the adult stage. In 1914 the adults were very numerous. The larvae are not cannibals in the sense that they devour each other, but they often attack and wound one another and these wounds, however slight, often prove fatal, as they provide means of entry for noxious bacteria. The chief bacteria causing the death of the larvae are: *Bacillus graphitosus* and *B. septicus insectorum*, to which must be added *Micrococcus nigrofaciens*, recently discovered in America. These also attack Scarabaeid larvae, and in the case of *Rhizotrogus* infection occurs even in the absence of wounds. As regards measures against *Melolontha*, experiments have been made with the one used in the South of France, consisting of immersing the roots of vine-seedlings before planting in a poisonous fluid composed of about 9 oz. sodium arsenate, 18 oz. lead acetate, 2 lb. gelatine, 2 lb. powder of *Aloe capensis*, 2lb. finely ground lime and 20 gals. water; but the results were rather indefinite.

Among pests of fruit trees, *Eriosoma lanigerum*, Hausm., appeared in some districts, having been imported from Rumania and from the government of Cherson. A statement made in the previous report as to the hibernation of *Eulecanium cerasi*, L., is now corrected, as further observations have shown that the larvae which were found hibernating on fallen leaves are those of Aleurodids. The control of scale-insects may be effected by smearing the trunks and branches of infested trees in winter, or in any case before the buds swell, with pure kerosene, or by spraying or smearing with 3 per cent. sulphide of lime or California mixture. Observations on *Hoplocampa fulvicornis*, Klug, have shown that this sawfly has only one generation during the summer, the larvae leaving the trees and pupating in the soil at the end of May or the beginning of June, remaining in that stage till the middle of the following April. The cocoons are scattered in the ground round the tree over an area having a diameter corresponding to that of the crown. Attempts have been made to find some means of delaying the exit of the imago from the soil, so as to allow the trees to form fruits before they appear. Ramming the soil twice during April was tried and the results obtained, although not conclusive, tend to show that, when done in time, this may destroy a considerable number of the cocoons, as well as delaying the emergence of the remainder.

Pests of field-crops included the larvae of *Lema melanopa*, which are able to resist many powerful insecticides; but the fact that they are covered with a considerable amount of slime was utilised to test the effect of powdering with mixtures of cement, sand and Paris green [see this *Review*, Ser. A, iv, p. 218]. *Pyrausta nubilalis* (*Botys silacealis*) has greatly increased of late in Bessarabia; besides the usual remedies, the sowing of an American variety of maize (Longfellow) as a trap-crop has been suggested; it is thought probable that sowing of millet may serve the same purpose.

Experiments were carried out to test the effect of various insecticides on plants; $1\frac{1}{2}$ per cent. California mixture ($1\frac{1}{2}$ lb. of sulphur, $1\frac{1}{2}$ lb. of slaked lime, $1\frac{1}{2}$ lb. of salt in 3 gallons of water) slightly scorched leaves of apricots, while leaves of pears, apples and plums were unaffected

by it ; a 3 per cent. solution of the same insecticide seriously scorched the foliage of apples and apricots, but only slightly that of pears. A 10 per cent. kerosene emulsion ($1\frac{1}{2}$ lb. of kerosene, $\frac{1}{4}$ lb. of soft soap in 2 gallons of water) produced marked scorching on leaves of apricots, but only slightly affected those of pears ; 8 per cent. and 6 per cent. solutions slightly scorched plums, though a 4 per cent. one caused practically no scorching. London purple was tested in the following combinations : (1) 3 oz. of purple, 6 oz. of slaked lime in 2·7 gallons of water ; (2) $3\frac{3}{4}$ oz. of purple, $7\frac{1}{2}$ oz. of lime in 2·7 gallons of water ; (3) 4·5 oz. of purple, 9 oz. of lime in 2·7 gallons of water ; and (4) $5\frac{1}{4}$ oz. of purple, $10\frac{1}{2}$ oz. of lime in 2·7 gallons of water ; almond foliage suffered from each of these, while plums were affected only by the last one.

This report also describes the work done by the Station in organising and assisting the control of various pests in different parts of Bessarabia at the request of the authorities or of the public. Several bulletins and pamphlets were published, of which some 30,000 copies were distributed, while some ten new demonstration orchards were opened in 1915.

Krassilstchik (I. M.). **Луговой мотылекъ и мѣры борьбы съ нимъ.** [*Phlyctaenodes sticticalis*, L., and its Control.]—Published by the Bio-Entomological Station of Bessarabia. *Kishinev*, 8 pp., 1 table of figs. N. D.

In this bulletin a short and popular account of the life-history and control of *Phlyctaenodes* (*Eurycreon*) *sticticalis*, L., is given, the moth being described and figured.

Arkhipov (P.). **Промышленная культура шиповника какъ подвоя.** [The industrial Cultivation of Rose Trees for Grafting.]—**«Садъ и Огородъ.»** [*Orchard and Market-Garden*], *Moscow*, xxxii, no. 10–12, October-December 1916, pp. 210–223. [Received 10th April 1917.]

Melolontha is a serious pest of roses, particularly near oak-forests, and in these situations it is better not to attempt to grow them. *Lymantria dispar*, which destroys the young shoots, can be successfully controlled by smearing the eggs with kerosene and by spraying in summer with Paris green ($\frac{1}{2}$ lb. of green in about 60 gallons of water). The rose aphis can be controlled by spraying with quassia decoction for which an extract of *Quassia amara*, not of *Picraena excelsa*, should be used.

Galkov (V. P.). **Изъ наблюденій, связанныхъ съ яблонной плодожоркой.** [Observations connected with *Cydia pomonella*, L.]—Published by the Entomological Bureau of the Zemstvo of the Govt. of Kursk. *Kursk*, 1917, 9 pp., 2 figs.

The first part of this paper describes the value of woodpeckers in destroying caterpillars and cocoons of *Cydia pomonella*. The two species prevalent in the government of Kursk are *Gecinus canus* and

G. viridis. Trap-belts containing no insects are not touched by the birds, while those torn by them always contain remnants of destroyed cocoons.

The second part deals with the number of caterpillars of *Cydia pomonella* found in individual fruits. Of 500 apples examined, 449 or 89·8 per cent. contained only one and 51 or 10·2 per cent. contained more than one caterpillar. Details are given of the numbers of caterpillars in the latter category, and it is concluded that in not more than 10 per cent. of cases do the females deposit more than one egg on one apple.

Къ борьбѣ съ саранчей. [The Campaign against Locusts.]—**« Земледѣльческая Газета.»** [*Agricultural Gazette*], *Petrograd*, no. 7 (175), 3 March 1917, p. 165.

The Council of the Governor-General of Turkestan has assigned about £100,000 for the campaign against locusts in 1917. Egg-clusters have been found on an area of 270,000 acres and it is proposed to utilise the services of soldiers and prisoners of war to conduct the operations.

Pettey (F. W.). **The Codlin-moth and its Control in the Western Province.**—*Union of S. Africa, Dept. Agric., Pretoria,* Sci. Bull. no. 9, 48 pp., 7 figs., 11 tables.

In connection with work on the control of codling moth [*Cydia pomonella*] in South Africa, the life-history of which is described, it has been found that even in orchards near sources of infestation three or four sprays are effective in controlling this pest in pears, if the applications are made thoroughly and at the right time. When pears are to be picked at or before the middle of February, the first spray should be applied soon after the petals drop and the second just before the eggs of the second generation hatch. When three sprays are applied, as is advisable, the first should be used just after the blossoms drop, the second, ten days to two weeks later, and the third about the 20th December, just before the second generation larvae begin to hatch. An additional late spray applied about the first of February is recommended for fruits ripening near or after the middle of February. In orchards that for some reason have not been adequately sprayed the use of bands may be effective, especially from the middle of November to the middle of January. These bands should be examined at, at least, seventeen day intervals and the larvae removed and destroyed. They have been found to be of no use where Argentine ants [*Iridomyrmex humilis*] are present in numbers.

The parasitic enemies of the codling moth in the Western Province include the Chalcid, *Trichogrammoidea lutea*, which is indigenous to South Africa. It also attacks the so-called Natal codling moth, *Argyroploce* (*Enarmonia*) *batrachopa*, a native species injurious to oranges. Four other species of Hymenoptera were bred from codling moth larvae during the season, including the Ichneumonid, *Pimpla heliophila*. Under natural conditions these parasites have not been found to act as complete controls.

The tables given show the results of experimental spraying in detail.

HUTSON (J. C.). **Insect Notes.**—*Agric. News, Barbados*, xvi, no. 388, 10th March 1917, p. 74.

The commonest pests of the sweet potato in Barbados are the scarabee (*Euscepes batatae*), the sweet potato moth (*Protoparce cingulata*), red spider (*Tetranychus telarius*) and the sweet potato weevil (*Cylas formicarius*), which also occurs in Jamaica, British Guiana, Cuba, the Bahamas and the Southern United States, but, so far, is not known to occur in the Lesser Antilles.

E. batatae can only be controlled by a rotation of crops and by not planting sweet potatoes on land on which they have been grown during the previous two years at least. The best method is to select a piece of land where there have been no potatoes for several seasons and plant it with small pieces of roots taken from fields known to be free from this pest. All roots showing the slightest sign of infestation should be destroyed. This land can be used as a nursery and cuttings taken from these plants for planting in uninfested ground. At the end of six or eight months, the nursery should be forked over and, if still free from *E. batatae,* may be used for the same purpose. Land badly infested with this weevil can be planted with other crops, but should be cleaned as thoroughly as possible first, all infested material, such as roots, vines, &c., being buried with lime. *C. formicarius* can also be controlled by these measures.

Protoparce cingulata, as well as the caterpillars of *Sylepta helcitalis*, can be killed by arsenical poisons such as Paris green, or arsenate of lead. *Tetranychus telarius* and *Euthrips insularis*, which is also occasionally found on the under-surface of the leaves of the sweet potato, can be controlled by dusting with a mixture of sulphur and lime.

Flea-beetles occasionally cause slight damage to the leaves of sweet potato and the grubs of the root borer [*Diaprepes*] and hard-backs occasionally attack the roots.

MOZNETTE (G. F.). **The Rose Flea-beetle** (*Haltica probata*, **Fall.**)—*Jl. Entom. Zool., Claremont, Cal.*, ix, no. 1, March 1917, pp. 13–19, 1 plate.

The rose flea-beetle (*Haltica probata*) occurs along the Pacific Coast from British Columbia to California. At Nelson, B.C., strawberries have been recorded as being attacked by *H. evicta*, Lec. [see this *Review*, Ser. A, p. 298], but the author is of opinion that the flea-beetle concerned was in reality *H. probata.* This species primarily feeds on the wild rose, but has been reported on several cultivated plants and there is some possibility of its becoming destructive to cultivated roses.

H. probata emerges from its winter quarters as the wild rose leaf-buds, on which it feeds, are beginning to open. The eggs are laid on the leaves, usually on the lower surface. The larvae attack the leaves, which they skeletonise. Pupation takes place in the ground, the adults emerging about August and hibernating. The adult is parasitised by a Tachinid fly, not yet identified.

Marlatt (C. L.). **Losses caused by Imported Tree and Plant Pests.**—*American Forestry, Washington, D.C.*, xxiii, no. 278, February 1917, pp. 75–80, 14 figs. [Received 18th April 1917.]

Following upon the report of the Federal Horticultural Board of the U.S. Department of Agriculture, recording the detection during 1916 of 193 imported insect pests, including 14 scale-insects, the brown-tail moth [*Euproctis chrysorrhoea*], egg-masses of European tussock moth [*Orgyia antiqua*], pupae of dagger moth [*Acronycta*], cocoons of pine sawfly [*Diprion simile*] and a potato weevil, the establishment of a national quarantine on plants, trees and nursery stock is advocated.

Some account is also given of the losses due to several of the more serious pests, such as *Anthonomus grandis* (cotton boll weevil), *Aspidiotus perniciosus* (San José scale), *Icerya purchasi, Euproctis chrysorrhoea, Cydia pomonella, Lymantria dispar, Cydia* (*Laspeyresia*) *molesta* infesting the peach, *Mayetiola destructor* (Hessian fly), etc.

Sanders (J. G.). **Save us from Invading Pests.**—*American Forestry, Washington, D.C.*, xxiii, no. 279, March 1917, pp. 147–153.

This paper emphasises the necessity for greater care in protection of imported stock from plant pests, and discusses the question of an embargo on importations of plants from the importers' point of view.

Boy Scouts battle Moths.—*American Forestry, Washington, D.C.*, xxiii, no. 279, March 1917, p. 165.

In Ohio, the State has for the first time called upon the Boy Scout organisation for help in the control of the tussock moth [*Hemerocampa*]; in a two weeks' campaign in the town of Canton, 3,000,000 eggs were collected. It is suggested that this precedent may be followed by other States to great advantage.

That Tent in the Tree.—*American Forestry, Washington, D.C.*, xxiii, no. 279, March 1917, pp. 171–172, 2 figs.

The necessity for searching out the egg-clusters of the tent caterpillar [*Malacosoma*] during the winter is insisted upon. The nests should be removed from the trees with a brush or by hand and the larvae crushed on the ground. Nests in the higher parts of a tree should be burnt out by means of a torch saturated with kerosene. The wild cherry is a favourite food-plant of these caterpillars, though apple, plum, peach, pear, rose and other trees may be attacked.

Chamberlin (W. J.). **Notes on some Buprestidae of Northern California, (Col.).**—*Entom. News, Philadelphia*, xxviii, nos. 3–4, March-April 1917, pp. 129–139 & 166–169, 6 figs.

The Buprestids collected in Northern California which are dealt with in this paper include 61 species. The following breed in the commoner conifers, such as Douglas fir, white pine and more especially the yellow pine :—*Chalcophora angulicollis*, Lec. ; *Dicerca sexulis*, Cr., *D. tenebrosa*, Kirby ; *Trachykele nebulosa*, Fall. ; *Buprestis rusticorum*,

Kirby; *B. lanta*, Lec.; *Melanophila consputa*, Lec. and *M. longipes*, Say (*acuminata*, De G.), these two species causing much annoyance to lumber men by their bite; *M. drummondi*; *M. gentilis*, Lec.; *Chrysobothris caurina*, Horn.; *C. laricis*, Van Dyke; and *Chrysophana placida*, Lec.

Buprestis laeviventris, Lec., seems to prefer old dry logs and poles without bark, being the only species which has been noted as depositing its eggs in or on such logs.

Chrysobothris nixa, Horn, and *C. viridicyanea*, Horn, are recorded as breeding only in incense cedar (*Libocedrus decurrens*) and *C. sylvania*, Fall., and *C. mali*, Horn, on fruit trees.

Agrilus politus, Say, was found on willows, in which it breeds, and oak. A blue form, which may be a distinct species, seems to be confined to the alder.

WOLCOTT (G. N.). **Influence of Rainfall on Abundance of Moth. (Lep.)** —*Entom. News, Philadelphia*, xxviii, no. 4, April 1917, p. 161.

From observations made over a period of several years in Louisiana, Cuba, Jamaica, Trinidad and Barbados and for two years in Porto Rico, it has been found that the abundance of the sugar-cane moth stalk-borer (*Diatraea saccharalis*) varies inversely with the rainfall [see this *Review*, Ser. A, iv, p. 115].

SCHLEIFER (S. A.). **Black Fly on Citrus Trees.**—*Jl. Jamaica Agric. Soc., Kingston*, xxi, no. 3, March 1917, pp. 88-89.

The author confirms the fact [see this *Review*, Ser. A, v, p. 238] that a small black ant preys upon the black fly of citrus [*Aleurocanthus woglumi*].

Citrus Black Fly around the Home.—*Jl. Jamaica Agric. Soc., Kingston*, xxi, no. 3, March 1917, pp. 88–89.

Citrus trees infested with *Aleurocanthus woglumi* should be sprayed with a solution of 1 lb. of laundry soap in 4 gals. of soft water, directing the spray on to the under-side of the leaves. If sprayed with clean water a few days later, the sooty mould will wash off. Badly infested trees may require a repetition of this treatment.

Experiments are to be made in controlling *A. woglumi* with the Coccinellid beetle, *Delphastus catalinae*, Horn, which is to be imported into Jamaica from California. This insect is being used to control the citrus whitefly [*Dialeurodes citri*] in California and Florida. Another Coccinellid, *Lioscymnus diversipes*, Ch., which is a native of Jamaica, already preys upon *A. woglumi*.

BARSS (H. P.) & LOVETT (A. L.). **Spraying Fruit Trees.**—*Oregon Agric. Coll. Exten., Corvallis*, Bulls. nos. 193–196, March 1917.

These popular bulletins are written for the guidance of fruit-growers and contain useful hints on spraying apples, pears, prunes, plumes, peaches and cherries, with spraying programmes for the various trees, notes on the best spraying materials and on the more important pests. Bulletin 193 also gives a table for calculating the dilution for lime-sulphur.

Seamans (H. L.). **Wheat-Sheath Miner.**—*Jl. Agric. Research, Washington, D.C.*, ix, no. 1. 2nd April 1917, pp. 17–25.

Two wheat-sheath miners, the habits of which are very similar, are *Meromyza americana*, Fitch, and *Cerodonta* (*Agromyza*) *femoralis*, Meig.

Very little has previously been published about the latter, though it is apparently of general occurrence in the north-western States and Canada. The host-plants of *C. femoralis* are wheat, oats and timothy (*Phleum pratense*), and, as the insect is only found in Graminaceosu plants, natives grasses are probably the natural food-plant. The various stages are described. There are apparently three full broods of *C. femoralis* in a year. The first adults appear about 20th May and oviposit until about 10th June. Immediately after hatching, which takes place in the insectary in about six days, the larvae begin to feed, and it is in this stage that the injury is done. The larva starts from that point in the leaf where the egg was deposited and mines down the leaf towards the stalk, ending in the leaf-sheath, at the crown of the plant, or at the first node. On reaching the base of the leaf-sheath the larva feeds up and down the sheath and sometimes around the stalk, causing the central stalk to wither and die. The injury appears to be identical with that caused by *M. americana*, but the mine cut by *C. femoralis* is narrow, clean-cut and almost straight, while that of *M. americana* is broad and irregular, with indistinct edges; the latter enters the stem and eats out the central stalk, and the former may girdle the stem, but does not completely cut it off. The length of the larval period varies from about 10 to 20 days. Cool, wet weather apparently retards pupation, which takes place either at the node or at the crown of the plant. The pupal period lasts about 25 days, and in the insectary, which seems to correspond closely with conditions in the field, the second brood appears about 15th July and the third about 7th September. The second brood of larvae cause slight injury to the plants just before blossoming; this occurs in the leaves only, the central stalk being uninjured. The amount of injury done to winter wheat during the autumn has not yet been ascertained.

Puparia of *C. femoralis* have yielded two Hymenopterous parasites, a new Braconid, *Dacnusa* sp., and the Chalcid, *Cyrtogaster occidentalis*; these were not however sufficiently numerous to be effective agents in control.

No control measures have yet been tried, but the following suggestions are made. When wheat is cut for harvest, the straw should be scattered over the field and the stubble burnt, as well as the grass borders surrounding the fields. This would destroy the larvae of the second brood, which are then in the last instar at the crown of the plant or have already pupated. If burning is not practicable, the stubble should be ploughed under about 6 inches and harrowed before planting a spring crop. This would probably bury the pupae deep enough to prevent the flies from emerging. Winter wheat should be sown late, about the third week in September, so that it would not be up until oviposition was over; this would prevent the main infestation in the spring. As native grasses are natural host-plants of the fly, crop rotation would be useless, but the clearing of grass borders and destruction of self-sown wheat during the fallowing period would be of great assistance in control.

SOUTH (F. W.). **A Summary of Locust Work in 1915.**—*Agric. Bull. Fed. Malay States, Kuala Lumpur,* iv, no. 5, February 1916, pp. 146–150, 1 table. [Received 20th April 1917.]

This report summarises the work done in controlling locusts during the year 1915, much of which has already been reported separately [see this *Review*, Ser. A, iv, p. 122, v, pp. 36].

The decrease in the number of locusts in the coast district has been very noticeable. The Tampin district has provided the most work, and efforts have been concentrated there in order to reduce as far as possible the number of locusts breeding on the lalang country to the east and north of Tampin.

In Johore there was no destruction work during the first quarter of the year. The locusts in this State have been confined throughout to the northern end and have been kept fairly under control.

In Selangor 202 swarms were destroyed in 1915, as compared with 3,118 in 1914. In Negri Sembilan a total of 6,071 swarms were destroyed as against 4,242 in 1914. This increase is due to the use of the poison method throughout the year in all places where it could be employed without danger and thus shows added efficiency in the work. In Johore the number of swarms destroyed was 1,505, which with those destroyed in the Federated Malay States gives a total of 7,778 swarms as compared with about 7,930 swarms in 1914. No locusts bred in Pahang in 1915. The cost of control work in 1915 was £6,586 as compared with £9,466 in 1914. This reduction in expenditure was due to the small amount of destruction work in Selangor, the use of the poison method, and also to the reduction in staff.

The amount of damage done by the locusts has been practically negligible. It is anticipated that in the coming year the locusts in Selangor will only occur as an occasional swarm flying northwards, while those in Negri Sembilan will be mainly confined to the Tampin district, and Tankak will remain the chief centre in Johore.

PESCOTT (E. E.). **Orchard and Garden Notes.**—*Jl. Dept. Agric. Victoria, Melbourne,* xv, no. 2, February 1917, pp. 126–127.

The control measures for scale-insects on evergreen trees including citrus recommended in this paper are: spraying with a weak red-oil emulsion, lime-sulphur, or resin wash, or fumigation, the last being the most successful method. The trees should be enclosed in an air-tight sheet or tent. A wooden, enamel or earthenware vessel is placed inside the tent containing a mixture of 4 fluid oz. sulphuric acid and 12 fluid oz. water, the acid being placed in the vessel first; 4 oz. of cyanide of potassium are then quickly dropped into the vessel and the tent closed at once; the bottom of the tent should be covered with soil to prevent any of the gas escaping. Fumigation should be carried out at night or on a cloudy day, when the foliage is quite dry.

NEWTON (L. V.). **The Domestication of the Indian Honey-Bee.**—Separate, dated 3rd September 1916, from *Agric. Jl. India, Calcutta,* xii, no. 1, January 1917, pp. 44–57, 6 plates. [Received 21st April 1917.]

In this article the author describes some of his experiences in the domestication of the yellow variety of the Indian honey-bee (*Apis*

indica) over a period of six years. Though the amount of honey extracted from the combs may not compare favourably with the results obtained from a similar number of hives of *A. mellifica* in other parts of the world, he attributes this to the fact that he was unable to give the bees sufficient attention rather than to inability on the part of the bees to be more productive. The view that these bees are of a vagrant disposition does not appear to be confirmed, as they desert the hives to form colonies elsewhere only when their wants are not attended to at the right time. Hives of these bees appear to be less prone to attacks of the wax-moth (*Galleria mellonella*), which mainly endeavours to established itself in those hives in which the bees are not numerous enough to cover the cells. By regulating the size of the hive to the number of the bees, the author sees no reason why the colonies should not be preserved for a number of years, and by improving the quality of the bees the yield of honey may be considerably increased. The natural food-yield of the district must also be considered when starting an apiary.

The author's apparatus and methods of obtaining fresh colonies are described, and the paper concludes with a few notes by Rev. Father Bertram on his experiences with the black hill variety of *Apis indica*, some colonies of which were kept for several years, though others would not colonise in hives.

BEESON (C. F. C.). **The Life-history of *Diapus furtivus*, Sampson, (Platypodidae).**—*Ind. Forest Records, Calcutta,* vi, no. 1, 1917, 29 pp., 2 plates. [Received 23rd April 1917.]

The Scolytid, *Diapus furtivus*, Samps., is known to attack only sal (*Shorea robusta*), though many insects associated with it in this tree attack others as well. It breeds normally in newly dead or felled trees and is therefore particularly abundant in felling areas. It is active throughout the year and is able to kill off trees with diseased roots, though its attack is not fatal to trees weakened by defoliation, creepers or unsuitable local conditions. The beetles bore a system of galleries in the sap-wood and heart-wood on a definite pattern and rear a brood of about 100 larvae. These larvae do not feed on the wood, but on an ambrosia fungus which grows on the walls of the brood galleries, supplemented by wood-sap.

The life-cycle from the egg to the mature beetle lasts about 10 or 11 weeks, though this does not necessarily represent the length of a generation, as both the oviposition period of the female and the feeding period of the young beetles before swarming are variable. Under the the most favourable conditions, it would be theoretically possible for a series of five generations to occur, provided that freshly felled or dead timber is available at each successive swarming period.

The chief economic importance of this pest lies in the technical damage done to unbarked timber by the formation of shot-holes and lines and stains in the wood. If forced to attack healthy living trees, the beetles do not penetrate beyond the outer layers of sap-wood, when they are drowned by the flow of resin that invades the entrance gallery. If, on the other hand, the timber is dead and dry, the sap may be insufficient to provide nourishment for the complete development of the larvae and they therefore die with the parent beetles.

The best method of control is to bark the trees early on felling areas and to remove newly dead trees in other parts of the forest.

Diapus furtivus is most subject to the attack of natural enemies in the adult stage. Among the most important of these are: the Colydiids, *Xuthia sicana*, Pasc., *Microprius difficilis*, Grouv., *Asosylus filiformis*, Grouv., and *Cerylon quadricolle*, Sharp ; the Cucujid, *Hectarthrum heros* Fhs. ; the Clerids, *Thanasimus* (*Tillicera*), *assamensis*, Steb., and *Stigmatium* spp. ; the Curculionid, *Phaenomerus sundewalli*, Boh. ; and the ant, *Oecophylla smaragdina*, F.

Hamilton (C. C.). **The Behaviour of some Soil Insects in Gradients of Evaporating Power of Air, Carbon Dioxide and Ammonia.**—*Biol. Bull. Mar. Biol. Lab., Woods Hole, Mass.*, xxxii, no. 3, March 1917, pp. 159–182. [Received 22nd April 1917.]

The experiments described in this paper extended over many months and were carried out on the larvae and adults of soil-inhabiting insects, chiefly the Carabid, *Euarthrus sodalis*, to ascertain their behaviour in altered conditions of air supply. The results show that larvae are much more sensitive to dry air and increased temperature than are the more resistant adults, but that they are less affected by a high percentage of carbon dioxide.

Morley (C.). **On some South African Ichneumonidae in the Collection of the South African Museum. Part I.**—*Annals. S. African Museum, Cape Town*, xv, no. 5, 1st December 1916, pp. 353–400. [Received 24th April 1917.]

This paper deals with 87 species of Ichneumonidae belonging to five subfamilies, 50 species being described as new.

Villeneuve (J.). **A new Species of Tachino-Oestrid from South Africa (Diptera).**—*Annals S. African Museum, Cape Town*, xv, no. 6, 8th December 1916, pp. 465–468. [Received 24th April 1917.]

Rondaniooestrus apivorus, gen. et sp. n., is described, a female of which from Port Elizabeth is said to have been bred from a honey bee.

Villeneuve (J.). **A Contribution to the Study of the South African Higher Myodarii (Diptera Calyptratae) based mostly on the Material in the South African Museum.**—*Annals S. African Museum, Cape Town*, xv, no. 6, 8th December 1916, pp. 469–515, 8 figs. [Received 24th April 1917.]

This paper contains descriptions of new or little known species of Tachinidae and Anthomyidae. Forty-three new species are dealt with, belonging to 37 genera (of which 10 are newly erected) and two new sub-genera. *Stomatomyia metallica*, sp. n., was bred from the caterpillar of a Noctuid moth of the genus *Athetis* at Salisbury, Southern Rhodesia.

Mosséri (V.). **Le Ricin en Egypte.** [The Castor-Oil Plant in Egypt.]. —*Bull. Union Agriculteurs d'Egypte, Cairo,* no. 118, January-February 1917, pp. 1–29. [Received 24th April 1917.]

It is suggested that experiments might be made in feeding the silk-worm, *Attacus cynthia,* on the leaves of the castor-oil plant, with the object of establishing sericulture in Egypt. *A. cynthia* has been successfully reared on this plant in India, and although it does not produce silk of such high quality as *Bombyx mori,* it is a hardier species, being less subject to disease and more resistant to inclement weather.

Chase (W. W.). **Experimental Dusting and Spraying of Peaches.**—*Georgia State Bd. Entom., Atlanta,* Circ. no. 21, February 1917, 15 pp., 4 plates, 3 tables.

Results of three seasons experiments in dusting peach trees against peach curculio, peach scab and brown rot, have given encouraging results. One drawback has been the tendency of the dust to cause defoliation and to split or crack the peaches, but it appears to be possible to avoid this. Most of the foliage and fruit injury noted in the tests, while somewhat influenced by weather conditions, is attributable to the use of too much dust. The dust mixtures used were composed of superfinely ground sulphur and powdered arsenate of lead. In two of them hydrated lime was added and this helped to reduce the cost of the mixture. The sulphur and arsenate of lead mixture contained 95 parts of finely ground sulphur (100 per cent of which would pass through a 200 mesh screen) and 5 parts lead arsenate. The sulphur-lead-lime mixtures were composed respectively of 45 per cent sulphur, 5 per cent lead and 50 per cent lime, and 60 per cent sulphur, 5 per cent lead and 35 per cent lime. The addition of the lime prevented the tendency to form lumps that occurred when sulphur and arsenate of lead only were mixed together. The mixtures were applied by means of a motor-driven dusting apparatus, from the windward side of the trees. This should be done when it is not raining or too windy, and should be continuous.

The results attained were most satisfactory, giving almost perfect control, a thorough and uniform distribution of material, a saving of time, labour, teams and initial cost, an independence of water and little deterioration of apparatus and none of material.

Rose (W. A.). **The Cyclamen Mite.**—*Agric. Gaz. Canada, Ottawa,* iv, no. 3, March 1917, pp. 174–175, 1 fig.

Many cyclamens in Ontario died from disease in 1916, one grower losing as many as 90 per cent. of his plants. The injury was found to be due to a mite, a species of *Tarsonemus,* which also attacks green-house plants on the Pacific Coast.

To control this pest, the plants should be sprayed with nicotine solution when they are first transferred to pots, and again at 10 day intervals until the buds are formed. The addition of 4 oz. of soap to 5 gals. of spray would probably increase its efficacy.

Criddle (N.). **Further Observations upon the Habits of the Western Wheat-stem Sawfly in Manitoba and Saskatchewan.**—*Agric. Gaz. Canada, Ottawa,* iv, no. 3, March 1917, pp. 176–177.

This paper supplements a former one on the western wheat-stem sawfly (*Cephus occidentalis*) [see this *Review*, Ser. A, iii, p. 630]. This insect breeds in its native state chiefly on wild grasses belonging to the genus *Agropyron.* On sandy soils the grass most commonly infested is *A. richardsoni*; on richer soil, especially in more western latitudes where this grass is less prevalent, it may be found more especially on *A. smithi,* a grass which closely resembles *A. repens* (couch grass). *A. smithi* is a common grass on the western prairies and is of considerable economic importance. In very dry years its stems seldom attain the size sufficient to accomodate the sawfly larvae, but under ordinary weather conditions about 30 per cent. of these are available as breeding places, while under abnormal ones 90 per cent. may become suitable for this purpose. The importance of this sawfly as a pest therefore depends directly upon the rainfall. Though the sowing of cereals, especially wheat and rye, has placed an unlimited supply of food at the disposal of this pest, yet it sometimes gradually disappears from cultivated crops, as if they were not wholly suitable to its requirements. *A. repens* is even more suitable as a food-plant for *C. occidentalis,* as, under normal conditions, it provides nearly 100 per cent. of stems in which it may breed, while it is a weed of the first rank. Species of lyme grass (*Elymus*) are also food-plants of great importance, especially as they are perennials.

One control measure consists in the sowing of a trap-crop of either wheat or rye, as early as possible in the spring, between the last year's infested area and the new crop. The sawflies emerging from the old stubble in June will breed upon this trap-crop, which can be either ploughed up or cut down in July and the infested stubble destroyed by burning.

Spraying Experiments.—*Agric. Gaz. Canada, Ottawa,* ix, no. 3, March 1917, pp. 193–214.

Under this heading are included a number of papers from the different provinces of the Dominion emphasising the good results of spraying work conducted at the various experiment stations in Canada; the greater part of the information given has already been noticed in this *Review.*

Back (E. A.). **The Mediterranean Fruit Fly.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vi, no. 3 & 4, April 1917, pp. 69–80, 5 figs., 2 plates.

The Mediterranean fruit-fly (*Ceratitis capitata*) is found in South America, Africa, southern Europe, Asia Minor and Australia. Though it does not yet occur in the North American continent, its presence in Bermuda and the Hawaiian Islands is a constant source of danger. The object of this paper is to call attention to the seriousness of the situation threatening the more tropical portions of the United States, and to show that everything possible is being done by the Federal and

State officials to prevent its establishment in California. The chief source of danger is the traveller who may have a few infested exotic fruits in his baggage or pockets.

Smith (H. S.). **Insect Parasites and Predators as Adjuncts in the Control of Mealy Bugs.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vi, no. 3 & 4, April 1917, pp. 108–114, 9 figs.

About twenty different species of mealy bugs are to be found in California but only three are usually found on citrus trees, viz. :—*Pseudococcus citri* (citrus mealy bug), *P. bakeri* (Baker's mealy bug) and *P. citrophilus* (citrophilus mealy bug). These are entirely resistant to fumigation as ordinarily carried out. If strong enough to kill the scales, serious injury to the trees results. The most satisfactory method of controlling these pests has been found to be the introduction of parasitic and predaceous enemies, and in order to get the greatest results by this means the trees must be protected against ants, especially the Argentine ant [*Iridomyrmex humilis*].

Predaceous insects which attack mealy bugs are :—the brown lacewing (*Sympherobius californicus,* Banks), which would be more valuable if it were not itself parasitised by a species of *Pachyneuron,* another Pteromalid, a Cynipid and the Chalcid, *Isodromus iceryae* ; the Coccinellid, *Hyperaspis lateralis,* Muls., would also be more valuable but for an internal parasite *Homalotylus* sp., which destroys large numbers ; *Cryptolaemus montrouzieri,* Muls. ; *Scymnus sordidus,* Horn ; *S. guttulatus,* Lec. ; *S. marginicollis,* Mann. ; *S. bipunctatus,* Kug. ; *Rhizobius ventralis,* Er. ; the Agromyzid, *Leucopis bella,* Lw., which is at present by far the most important enemy of *P. citrophilus* ; and the Syrphid, *Baccha lemur,* O.S., which is common in the southern part of the State and is, at times, of considerable practical importance.

The parasitic enemies are :—*Paraleptomastix abnormis,* Gir. ; *Chrysoplatycerus splendens,* How., which seems to be confined to *P. citri* ; *Pseudleptomastix squamulatus,* Gir. ; *Epidinocarsis subalbicornis,* Gir. ; *Anagyrella corvina,* Gir. ; and *Pseudaphycus* sp.

Maskew (F.). **Quarantine Division. Report for the month of January 1917.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vi, no. 3 & 4, April 1917, pp. 119–120.

The following pests were intercepted :—From Central America :—*Aspidiotus cyanophylli* and *Selenaspidus articulatus* on bananas. From China :—*Cylas formicarius* in sweet potatoes ; *Pseudaonidia* sp., *Parlatoria* sp., and *Pseudomonas citri* on pomelos and oranges. From Hawaii :—*Pseudococcus bromeliae* and *Diaspis bromeliae* on pineapples ; *Coccus longulus* on betel leaves ; *Bruchus* sp. in seeds, *Asterolecanium,* sp., *Coccus hesperidum* and *Chrysomphalus aonidum* on oleander cuttings. From Japan :—Lepidopterous larvae in dead wood of persimmon trees ; *Pseudococcus* sp. and cicada eggs on wistaria ; cicada eggs on persimmon trees ; *Cladosporium citri* on oranges ; larvae of *Bruchus* sp. in chestnuts ; *Aulacaspis pentagona* on peach ; *Chrysomphalus aonidum* (*ficus*) and *Hemichionaspis aspidistrae* on aspidistra ; a Coccid on pear ; Lepidopterous larvae in walnuts ;

Lepidosaphes lasianthi and *Coccus hesperidum* on camellias; *Cecidomyia* sp. on daphne. From Java:—*Ceroplastes rubens, Lepidosaphes gloveri, Chionaspis citri* and *Parlatoria pergandii* on oranges. From Holland:—*Lepidosaphes ulmi* on boxwoods; larvae of a leaf-roller on azalea. From Sydney:—a Coccid on orchids; Lepidopterous larvae on peach trees. From Idaho:—*Rhizoctonia* on potatoes. From Mexico:—Lepidopterous larvae in dates; and *Chrysomphalus aurantii* on citron. From Texas:—*Dialeurodes citri* on Cape jasmine; *Aspidiotus perniciosus* on apple. From Kansas:—borers in peach trees. From Ohio:—*Dialeurodes* sp. and *Pseudococcus* sp. on ornamental plants.

Gillette (C. P.). **Seventh Annual Report of the State Entomologist of Colorado for the Year 1915.**—*Office of the State Entomologist, Fort Collins,* Circ. no. 19, June 1916, 43 pp., 11 tables. [Received 25th April 1917.]

This report, which includes those of the various county horticultural inspectors, records a number of insects pests, but gives no scientific names. San José scale [*Aspidiotus perniciosus*] has spread somewhat through the State, but the infestations are for the most part light, while in two localities it appears to have been eradicated. The fruit-tree leaf-roller [*Cacoecia argyrospila*] was kept under control until 1913 by the use of miscible oil sprays, but, owing to negligence, it has again become a serious pest. Infestations of rosy apple aphis [*Aphis malifoliae*] were recorded in several counties; it is a comparatively new pest. The codling moth [*Cydia pomonella*] is probably the most serious pest in the State; owing to the lack of fruit in some of the worst infested areas, little attention has been paid to it and it is hoped that this scarcity of fruit will have held it in check. Two serious infestations of pear-leaf blister-mite [*Eriophyes pyri*] occurred on apple. Shade-trees were infested by the locust borer (*Cyllene robiniae*), which is spreading rapidly. The shipping of black locust trees (*Robinia pseudacacia*) outside the immediate neighbourhood of the infested district has been forbidden. All infested trees should be destroyed and no more planted until the pest has been eradicated.

Rohwer (S. A.). **Two Bethylid Parasites of the Pink Boll Worm.**—*Insecutor Inscitiae Menstruus, Washington, D.C.,* v, nos. 1–3, January-March 1917, pp. 1–3. [Received 25th April 1917.]

Perisierola nigrifemur, Ashm., and *P. emigrata*, sp. n., formerly thought to be *P. cellularis*, Say, both parasitic on the larvae of the pink boll worm [*Gelechia gossypiella*] are described.

Busck (A.). **Notes on *Perisierola emigrata*, Rohwer, a Parasite of the Pink Boll Worm.**—*Insecutor Inscitiae Menstruus, Washington, D.C.,* v, nos. 1–3, January-March 1917, pp. 3–5. [Received 25th April 1917.]

Perisierola emigrata was first noticed in the Hawaiian Islands in 1912, probably having been introduced from Texas in 1910 in an attempt to establish a parasite of the beetle larvae which are injurious to the pods of algaroba (*Prosopis juliflora*) used as cattle fodder. In

1915 it was found on all the cotton fields on the Island of Oahu, and on part of Hawaii. The larva is externally parasitic on the full-grown larva of *Gelechia gossypiella*, but is not an effective check, destroying only a small percentage, though is it equally active indoors among seeds and in the bolls in the fields. This species has been referred to as *Goniozus cellularis*, Say, in Hawaiian literature.

GIRAULT (A. A.). **A Chalcid Parasite of the Pink Boll Worm.**—*Insecutor Inscitiae Menstruus, Washington, D.C.*, v, nos. 1–3, January —March 1917, pp. 5–6. [Received 25th April 1917.]

Stomatoceras pertorvus, sp. n., is described, being the same as that referred to in Hawaiian publications as *Hockeria* sp.

HOWARD (L. O.). **A New Aphis-feeding** *Aphelinus*.—*Proc. Biol. Soc., Washington, D.C.*, **xxv**, 31st March 1917, pp. 77–78.

Aphelinus lapisligni, sp. n., is described from numerous specimens reared from *Aphis bakeri*, Cowen, in Oregon.

HUTSON (J. C.). **The Sugar-cane Froghopper in Grenada.**—*Agric. News, Barbados*, **xvi**, no. 389, 24th March 1917, p. 90.

Tomaspis saccharina, Dist., found on sugar-cane in Grenada, is considered to be the same species as that found in Trinidad. It has evidently been established in Grenada for some years, fields that have been under pasture being apparently the most heavily infested. Conditions favourable to the pest seem to occur in those fields where there is no excessive amount of moisture, but which are not extremely dry. In Trinidad the planting of cover-crops to keep down grass has been recommended, or a border of about 100 feet can be planted on abandoned fields adjacent to canes. Clean cultivation reduces the number of froghoppers. The larvae of the Syrphid, *Salpingogaster nigra*, Schin., exercise a considerable degree of control on the froghopper nymphs in Trinidad, where they have been artificially bred and distributed, but these are not present in any numbers in Grenada. *Metarrhizium anisopliae* is a natural enemy of this pest in Trinidad and spores of this fungus have been distributed over infested fields in Grenada; the results of this experiment are not yet known. Other natural enemies are Attid spiders and the predaceous grasshopper, *Xiphidium* sp., both of which are scarce in Grenada. The infestation of froghoppers is not at present severe, but will need to be kept under observation.

Preliminary Trials with Cacao Thrips Fungus.—*Agric. News, Barbados*, **xvi**, no. 389, 24th March 1917, p. 94.

In experiments with cultures of *Sporotrichum globuliferum* sent from St. Vincent to Grenada for the control of thrips, a number of parasitised nymphs and adults were obtained from cacao plants in boxes which had been supplied with thrips in all stages and then sprayed with the fungus. Experiments with the fungus, *Metarrhizium anisopliae*, were inconclusive. It is proposed to repeat these experiments and to make field trials in humid situations when the wet season infestation begins.

Brittain (W. H.) & Good (C. A.). The Apple Maggot in Nova Scotia. —*Nova Scotia Dept. Agric., Truro, N.S.*, Bull. no. 9, January 1917, 70 pp., 6 plates, 1 fig. [Received 26th April 1917.]

This bulletin contains records of the continuation and extension of work on the apple maggot, *Rhagoletis pomonella* [see this *Review*, Ser. A, iv, p. 370]. Tables are given showing the distribution; results of inspection; susceptibility and relative infestation of varieties; rates of emergence; length of life of adults and larvae in different varieties; depth to which the larva penetrates the soil; effect of cultural methods and chemicals on the pupae; spraying tests and results in laboratory and field.

Muir (F.). On the Synonymy of *Delphax maidis*, Ashm.—*Canadian Entomologist, London, Ont.*, xlix, no. 4, April 1917, p. 147.

This paper confirms the identity of *Pundaluoya simplicia*, Dist., with *Delphax maidis*, Ashm., the latter having priority. This species has been recorded from North America, Hawaii, Fiji, Australia, Amboina, Java, the Philippines, Formosa, Malay Peninsula, British India, Ceylon, Seychelles, West Africa, Cuba, Nicaragua and Brazil. In the Malay Peninsula and in the Philippines the insect lives on native grasses, as well as on *Zea mays*, but its original host-plant is unknown.

Weiss (H. B.). The Status of *Lecanium corni*, Bouché, in New Jersey. (Homop.).—*Canadian Entomologist, London, Ont.*, xlix, no. 4, April 1917, pp. 119–120.

Eulecanium (*Lecanium*) *corni*, Bch., has been widely distributed in North America for some years past on a variety of fruit and other plants. It has been recorded recently in nurseries in New Jersey on boxwood, having evidently been imported from Holland on this plant within the last few years.

Froggatt (W. W.). A Descriptive Catalogue of the Scale Insects (Coccidae) of Australia.—*Agric. Gaz. N.S.W., Sydney*, xxviii, no. 2, February 1917, pp. 134–140, 1 plate, 1 fig.

The species recorded include:—*Pseudococcus casuarinae*, Msk., on an undetermined species of *Casuarina*; *P. nivalis*, Msk., on *Acacia*; *P. stolatus*, sp. n., on *Myoporum deserti*; *Epicoccus acaciae*, Msk., on *Acacia*; *Lachnodius eucalypti*, Msk., on various species of eucalyptus; *L. hirtus*, Msk., on wattle (*Acacia* sp.); *L. lectularius*, Msk., on *Eucalyptus rostrata* and *E. corymbosa*; *Ripersia leptospermi*, Msk., on *Leptospermum*; *Antonina australis*, Green, on the roots of *Cyperus rotundus*.

Schneider-Orelli (O.). Temperaturversuche mit Frostspannerpuppen, *Operophthera brumata*, L. [Temperature Experiments with the Pupae of *Cheimatobia brumata*, L.]—Reprint from *Mitt. der Entomologia Zürich u. Umgebung*, no. 2, 1916, pp. 134–152. [Received 12th April 1917.]

Reliable reports show that the flight period of *Cheimatobia brumata* takes place in the mountains earlier than in lower-lying districts.

This is to be expected, as at the higher altitudes the moths could not emerge at such a time as November owing to the covering of snow. Even were the flights to occur at the same time, the pupal stage would still be shorter in the mountains, owing to the later spring delaying pupation. Reports on *C. brumata* are very conflicting. In the Zürich district, for instance, the author has never seen adults between New Year and spring, nor has he observed pupation to be prolonged until autumn.

From the experiments described in this connection, it appeared that the egg-stage, which lasts about 5½ months in the Zürich district, takes longer in the mountains, but may be reduced to about one-fifth if the eggs are subjected to a high temperature. The larval stage, which averages six weeks near Zürich, is also greatly reduced in length at artificially raised temperatures; at 77° F. only a fortnight is necessary. The pupal stage, usually lasting about 5 months, could not be shortened in anything like the same proportion. In one experiment only, in which the moths emerged in mid-July, did this stage average 4½ months. The removal of pupae from the valleys to a point about 6,500 feet higher up, or to artificially cooled chambers, repeatedly caused a distinct, though unimportant, delay in the emergence of the adults. It is however probable that pupation only lasts 3½ months at the highest altitudes in Switzerland where this moth occurs. These experiments show that the emergence of the adults depends on the rate at which the pupae mature and is not accelerated by the action of cold.

Schneider-Orelli (O.). **Die Frostspannerbekämpfung im Frühjahr.** [The Control of *Cheimatobia brumata* in Spring.]—*Schweiz. Zeitschr. Obst- u. Weinbau, Frauenfeld,* xxvi, no. 7, 31st March 1917, pp. 97–101.

If the banding is in comparatively good condition after the winter, it should not be removed from fruit trees until May in order that the larvae of *Cheimatobia brumata* that hatch from eggs deposited on the trunk may be prevented from ascending. All that is necessary is to remove a strip of the hardened upper layer of adhesive from $\frac{2}{5}$ to $\frac{4}{5}$ of an inch wide, or to place a strip of fresh material of this width over the old band. As the newly hatched larvae are only 2 millimetres long, they are held fast by very small quantities of adhesive. If the bands are in such a condition as to be useless, or if they have have been removed during the winter, it is advisable to scrub the trunk up to the point where the banding had been applied with a 10–15 per cent. solution of soft soap, with lime-sulphur mixture diluted with three times its bulk of water, or with a 2 per cent. tobacco extract. This must be done not later than early in April in order to kill the eggs, and is cheaper than applying new bands. A 15 per cent. strong milk of lime may also be used. This spring treatment is useless in cases where banding has not been applied in the preceding autumn. In the case of small trees neglect in banding may be remedied to some extent by spraying with a home-made 2–3 per cent. soft-soap solution. The spray must be a very fine one at high pressure if the larvae are to be killed.

Hausammann (R.). **Die Blutlaus.** [The Woolly Aphis.]—*Schweiz. Zeitschr. Obst- u. Weinbau, Frauenfeld*, xxvi, no. 8, 14th April 1917, pp. 122–124.

This is a popular article on the woolly aphis [*Eriosoma lanigerum*], and contains no new information.

La Face (Lidia). **La metamorfosi dell'** *Aclerda berlesii*, **Buffa (Hemiptera-Coccidae.)** [The Metamorphosis of *Aclerda berlesii*, Buffa.]—Separate, dated 30th March 1917, from *Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric., Portici*, xi, pp. 235–249, 8 figs.

This paper describes the various stages of postembryonic development of *Aclerda berlesii*, Buffa, living on *Arundo donax* and common in central and southern Italy. The question as to whether this species should be considered a Lecaniid is discussed.

Raymundo (B.). **Uma praga das açucenas.** [A Pest of *Amaryllis princeps*.]—*Chacaras e Quintaes, Rio de Janeiro*, xv, no. 3, 15th March 1917, pp. 220–221, 3 figs.

The caterpillars of the Noctuid, *Xanthopastis* (*Glottula*) *heterocampa*, Gn., are reported as seriously injuring the leaves and bulbs of *Amaryllis princeps* in Brazil. *Pancratium hymenocallis caribaeum*, *Eucharis amazonica* and *Fittonia* sp., as well as many other ornamental plants, are also attacked.

Moreira (C.). **Como destruir o coccida das roseiras.** [How to destroy the Rose Coccid.]—*Chacaras e Quintaes, Rio de Janeiro*, xv, no. 3, 15th March 1917, p. 235.

To control *Chrysomphalus aurantii*, Msk., on roses, the use of petroleum-soap emulsion composed of: crude petroleum, 6½ parts, soap, 2½ parts, water, 4 parts, is advised.

LEGISLATION.

Cotton Boll Weevil. Amendment no. 1 to Quarantine Order no. 20.—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vi, no. 3 & 4, April 1917, p. 118.

Owing to the State of Arizona being free from the cotton boll-weevil (*Anthonomus grandis*, Boh.), Egyptian cotton seed may now be imported into the State of California. Two regulations dealing with the procedure which must be followed when applying for permission to do so have been laid down as an amendment to Quarantine Order No. 26.

These regulations do not apply to the experiments of the United States Department of Agriculture in the State of California.

A Proclamation under the Customs (Importation Prohibition) Law, 1916.—*Jamaica Gazette, Kingston,* xl, no. 14, 5th April 1917.

The importation into Jamaica of banana plants, suckers, cuttings, etc., or tools used in their cultivation, from any part of Central or South America or the Island of Trinidad, is prohibited by this proclamation.

Protection from Disease (Plants) Orders.—*Jamaica Gazette, Kingston,* xl, no. 14, 5th April 1917.

Under these orders, any plants imported into Jamaica from the United Kingdom or the United States of America are permitted into the port of Kingston only, where they are to be subjected to fumigation with hydrocyanic acid gas at the rate of one oz. of cyanide for every 300 cubic feet of space for a period of one hour. In the case of delicate plants with expanded foliage, half this dose of cyanide will be used and the exposure will be half an hour only. The importation into the island of any agricultural tools or implements that have been used, coming from any country whatsoever, shall only be permitted when a written permit has been obtained from the Director of Agriculture, to whom all such consignments must be addressed, and the Department of Agriculture will then decide whether such tools or implements can be admitted and will carry out any disinfection or fumigation that may be considered necessary to prevent the introduction of disease. Any part of such consignments may be destroyed at the discretion of the Director of Agriculture, without any compensation to the importer of the articles destroyed. Any plants or articles imported contrary to any of the provisions of this Order will be destroyed by the customs officials, without compensation to the owners of plants or articles so destroyed.

ENTOMOLOGICAL NOTICES.

Mr James Waterston, of the Imperial Bureau of Entomology, was gazetted Lieutenant R.A.M.C. on the 25th May 1917, and has been detailed for special entomological work with the British Expeditionary Force, Salonica.

Mr. Nigel K. Jardine has been appointed by the Ceylon Government to a temporary entomological post for the investigation of the Tea Tortrix in that Island.

NOTICES.

Secretaries of Societies and Editors of Journals willing to exchange their publications with those of the Bureau, are requested to communicate with the Assistant Director.

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VOL. V. Ser. A. Part 7.—pp. 273-336. JULY, 1917.

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Van der Goot (P.). **Verdere onderzoekingen omtrent de oeconomische beteekenis der gramang-mier.** [Further Investigations regarding the economic Importance of the Gramang-ant.]—*Meded. v. h. Proefstation Midden-Java, Salatiga,* no. 22, 1916, 122 pp., 35 tables, 6 plates.

The life-history of the gramang ant, *Plagiolepis longipes,* is here described in detail, though the major portion of this paper deals with investigations as to its economic importance [see this *Review,* Ser. A, iii, p. 663; v, p. 143]. The egg-stage lasts for about 18–20 days, the larval stage 16–20 days, and the pupal stage usually 20 days, the total duration being thus between 50 and 65 days in the case of the workers. The pupal stage of the queen occupies from 30 to 34 days. The winged males and females only appear during the second half of the east monsoon, after a more or less prolonged drought.

P. longipes is a scavenger, feeding on the dead bodies of other insects and small animals and rarely, if ever, attacking living insects. Both the larvae and full-grown individuals of *Helopeltis* are unmolested if alive, though their dead bodies are carried off. The helpless larvae and pupae of the beetle infesting the pods of *Tephrosia, Araecerus fasciculatus,* were carried away in the laboratory, but the ant was never observed to penetrate into growing pods in order to attack the larvae. *P. longipes* is therefore unimportant as a destroyer of insect pests. It also feeds on the honey glands which are found in many plants and are common on Leguminosae. This explains its numerous visits to shade-trees (*Caesalpinia, Deguelia, Albizzia,* etc.) and *Crotalaria striata,* though these may be uninfested by Aphids or Coccids. The gramang ant also abounds in places where fallen leaves and other débris are plentiful and Aphids and Coccids are scarce. This was often noticed in the cacao plantations and, during the dry weather, in the teak woods. The presence of the dead bodies of numerous insects, on which the ant can feed after Aphids and Coccids have become scarce, may account for this. The highest altitude at which *P. longipes* occurs is about 3,300 feet; at altitudes above about 3,900 feet it is rarely met with, being replaced by a big brown ant, believed to be *Myrmicaria brunnea.* This restriction in range does not affect the plantations of *Coffea robusta,* which are mostly below 3,300 feet. The lesser injury by *Coccus* (*Lecanium*) *viridis* (green scale) at and above this altitude is due, partly to the absence of *P. longipes,* but mainly to the development of the scale being retarded by the lower temperature. Mites are the chief enemies of *P. longipes. Tyroglyphus australasiae,* Oudms., feeds on the eggs while *T. krameri,* Berl., and *Anoetus longipes,* Oudms., live attached to the workers. A Tachinid fly, *Bengalia latro,* De Meij., was repeatedly observed robbing the nests of *Dolichoderus bituberculatus* (black cacao ant) and *P. longipes* and it probably attacks other ants living above ground. Poultry, small quails and other birds feed on the pupae and queens of *P. longipes.* In a previous paper [see this *Review,* Ser. A, iii, p. 663] the author was of opinion that *P. longipes* could not be said to protect *Coccus viridis* by building covered passagges, or carrying the scales about or destroying their natural enemies. The only way in which *P. longipes* favours the scale is by facilitating the evacuation

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of its excreta. A detailed account is given of experiments extending over four months which establish the fact that *P. longipes* has a peculiarly favourable influence on *C. viridis*; on ant-infested bushes, the death rate of the scales is considerably lower, they develop more rapidly, their parasitation by Ichneumonids is reduced, and their progeny is twenty times more numerous. The suggested explanation of these facts is that feeding is promoted in scale-insects in which excretion is accelerated by the stroking performed by *P. longipes.* It was noticed that feeding seems greatly to influence the development of the scale; on the same coffee bush the young scales on the shoots develop more rapidly than those on the leaves, which form a less suitable food.

In investigating whether other ants also benefit *Coccus viridis*, the choice naturally fell on the black cacao ant *Dolichoderus, bituberculatus*, which protects cacao against *Helopeltis* [see this *Review*, Ser. A, v, p. 143]. *D. bituberculatus* is seldom seen in plantations of *Coffea robusta*, but was frequently met with in those of Liberian coffee and, when this was replaced by cacao, the latter became infested. Experiments similar to those with the gramang ant showed that the death rate of the first generation of the scale was practically the same whether *D. bituberculatus* was present or absent; the development of *C. viridis* occupied on an average 83 days when no ants were present, 74 in the presence of the black cacao ant, and only 65 in that of the gramang ant; the average percentage of Ichneumonid parasitation was 39 per cent. when no ants were present, 3·5 per cent. in the presence of the black cacao ant, and 5·7 per cent. in that of the gramang ant; the average number of scales after $4\frac{1}{2}$ months was 70 on ant-free bushes, 403 on bushes infested with black cacao ants, and 1,057 on those infested with gramang ants. It is suggested that this difference in the influence of the two species may be due to differences in their behaviour. Only a few individuals from a gramang colony perform the milking; they move quickly over the scales and stroke lightly and for a short time only. On the other hand many members of a black cacao ant colony are employed and stroking is both heavy and prolonged, so that the sensitiveness of the scales is blunted instead of being stimulated.

Other ants occurring on Javanese coffee estates include *Oecophylla smaragdina*, *Pheidologeton diversus*, *Cremastogaster* spp., *Camponotus camelinus*, *Myrmicaria brunnea*, etc. Though no experiments were made, it was noticed that the advent of various ants among ant-free colonies of *C. viridis* always led to an increase of the latter. Some planters have attempted to drive away *P. longipes* by introducing other species, but, as *C. viridis* invariably thrives better when ants are present, not only *P. longipes*, but all other species should be kept away from coffee estates as much as possible.

The white cacao scale, *Pseudococcus crotonis*, Green, is abundant on, but apparently harmless to the pods and twigs of cacao, in the plantations of which it forms the chief attraction for *D. bituberculatus.* Under experimental conditions it was ascertained that *P. crotonis* died out on cacao trees uninfested by ants, while it flourished on ant-infested ones. Under natural conditions the scale usually disappeared, when the gramang ant was present, because this ant does not sufficiently protect it (as the black cacao ant does)

against parasitation by *Diplosis.* That the presence of the gramang ant is not of itself antagonistic to the development of the scale was proved in experiments in which *Diplosis* was absent. The practice of refastening to the cacao trees pods which have been plucked and emptied is useful only in plantations where the black cacao ant occurs. These data refer to *P. crotonis* and do not necessarily apply to other mealy bugs. For instance, *P. citri*, Risso, appears to thrive equally well on both ant-free and ant-infested trees. The lamtoro Coccid (*P. virgatus*), which is not much visited by ants, and *P. adonidum*, which is usually ant-free, also thrive in their absence.

The injuriousness of the gramang ant depends on the plant involved. In coffee plantations it is a most dangerous pest owing to its influence on *C. viridis.* On many estates this scale is present in such small numbers as to be practically negligible and such infestation remains stationary until the gramang ant appears, when it rapidly increases. It has been stated by Keuchenius that the gramang ant kills many insect pests, hinders the development of sooty fungus on coffee bushes and is an important distributor of *Cephalosporium lecanii* [see this *Review*, Ser. A, iii, p. 646]. The first of these conclusions has already been dealt with and data are adduced to prove that the other two are incorrect. In cacao plantations the gramang ant is also injurious, for it drives away the black cacao ant and does not itself efficiently protect *Pseudococcus crotonis* against *Helopeltis.* In this connection it is suggested that *Helopeltis* is disturbed by the active, dense masses of the black cacao ant, an effect which the sparse and smaller numbers of the gramang ant cannot produce. Cacao planters have sometimes ascribed a lessened fruit production to the gramang ant and the author states that in places where gramang infestation borders on black cacao ant infestation, the difference in production was very remarkable. This will be further investigated.

As regards the control of *P. longipes* [see this *Review*, Ser. A, iii, p. 664] it is pointed out that the removal of fallen leaves and other débris only causes the ants to enter the soil without leaving the plantation. The employment of other ants is inadvisable in coffee plantations and, though the black cacao ant may safely be introduced into cacao plantations, it has little chance of surviving in the presence of *P. longipes.* Attempts to poison the latter have failed, because the ants soon discover the poisons and avoid them. Traps made of sections of bamboo stuffed with dried leaves proved expensive and incapable of entirely ridding a plantation. For use in coffee and cacao plantations, when these ants abound, carbon bisulphide may be recommended, the minimum quantity required being 5 pints per acre. Trenches measuring about 5 feet long by 2 feet and 8–12 inches deep are dug at regular intervals, about 140 being required per acre. In cacao plantations this amounts to one trench per tree. Many small trenches are preferable to a few large ones. The plantation is thoroughly cleaned up and the fallen leaves are placed in the trenches, any surplus being burnt. At 20-inch intervals bamboo pipes are thrust into the mass of leaves which is then carefully covered with earth so that only the pipes stick out. Twenty cubic centimetres of carbon bisulphide are required per trench and this

quantity is divided equally between the three pipes in each trench. If this method of fumigation is carefully carried out during the west monsoon, the complete destruction of the gramang ant is assured, and if neighbouring estates are also treated there will be no re-infestation. The carbon bisulphide may also be poured into holes made by thrusting a stick into the leaves, but the bamboo pipes increase the efficacy and economy of this method.

Burying the infested leaves in trenches was only successful when the trenches were 18 inches deep. At this depth the result was tolerably good, but still inferior to that with carbon bisulphide, and, as this method aims at suffocating the insects, it must be practised in the rainy season; the experiments were conducted during the rains and in clay soil. Gasoline and another by-product of petroleum refining, aerogine, proved much less efficient than carbon bisulphide. This also applies to potassium cyanide, even in a solution of 2 per cent. strength, and to formalin. Banding experiments were made during the rains and a dry period lasting a few weeks. Under those conditions a material obtained from Amsterdam retained its adhesiveness for more than two months. Banded coffee bushes were entirely free from ants unless they were prevented from going elsewhere, in which case some of the workers crossed the banding. Up to the time of writing, no injury had been caused by applying the adhesive direct on the trunk instead of on a band of paper. Banding is suggested as a likely means of dealing with ants which are not so susceptible as *P. longipes* to control by means of trap-trenches and it is recommended against *Myrmicaria brunnea*, the nests of which are deep under ground.

Some supplementary notes are given on *Coccus viridis*, chiefly dealing with the points in which the author compares his experience with information given by Keuchenius. The latter has stated that the developmental period (by which the present author means the time up to the production of the first progeny) occupies about 45 days, whereas observations have shown it to last at least 65 days, thus proving that considerable individual variations occur. Again, the green scale increases in four months as from 1 to 400 and this increase, though great, is considerably lower than that stated by Keuchenius. The latter has pointed out that this scale attains a larger size on coffee than on *Gardenia florida*. It may be added that on coffee alone does this insect really thrive. Keuchenius has also stated that new food-plants are gradually being attacked, but the view here taken is that the increase observed is due to the greater attention now given to the subject. The following plants, not recorded by Keuchenius, are general and important hosts of this scale in central Java:—*Citrus aurantium* (orange), *Justicia betonica*, *Plumiera acutifolia* and *Psidium guajava* (guava).

Indigenous insect enemies of the green scale include:—The Coccinellids, *Chilocorus melanophthalmus*, Muls., *Orcus janthinus*, Muls., and the Chalcids, *Coccophagus bogoriensis*, Koningsb., *Myiocnema comperei*, Ashm., *Aneristus ceroplastae*, How., *Coccophagus* sp., *Cheiloneuromyia javensis*, Gir., *Cristatithorax latiscapus*, Gir. These species are briefly described and accounts of their life-histories are given.

ONRUST (K.). **Resultaten van het bespuiten van Frambozen met Carbolineum voor de bestrijding van *Lampronia rubiella*, Bjerk.** [The Results of spraying Raspberries with Carbolineum against *Incurvaria* (*Lampronia*) *rubiella*, Bjerk.]—*Tijdschr. Plantenziekten, Wageningen*, xxiii, no. 1, January 1917, pp. 17–30.

Since 1909, when the injury was first reported, considerable damage has been done to raspberries in North Brabant by *Incurvaria* (*Lampronia*) *rubiella*, Bjerk. The raspberry crop, which is universally grown, sometimes suffers to the extent of 50 per cent. through infestation by this moth, the life-history of which is briefly described [see this *Review*, Ser. A, iii, p. 741]. The larvae should not be confused with those of *Byturus tomentosus* and *B. fumatus* (raspberry beetles); these infest the fruit, which *T. rubiella* does not. The best controls are spraying with carbolineum or banding with adhesive material. The carbolineum should be of 8 per cent. strength and should be applied with a good spray-pump both to the foliage and roots. This should always be done before 15th March.

RITZEMA BOS (J.). **Mestkevers van het geslacht *Aphodius*, Ill., als Vijanden van de Champignon-kultur.** [Dung-beetles of the Genus *Aphodius*, Ill., as Enemies of Mushroom Culture.]—*Tijdschr. Plantenziekten, Wageningen*, xxiii, no. 1, January 1917, pp. 31–32.

Early in September 1916 dung-beetles were reported as injuring artificially grown mushrooms near Apeldorn. Most of the specimens received were identified as *Aphodius fimetarius*, L., the remainder being *A. ater*, De G. These beetles enter the beds of horse manure and feed on the mycelium in them. *A. fimetarius* is a well-known pest of mushroom beds in France.

SCHOEVERS (T. A. C.). **Proeven met eenige Chemicaliën ter Bestrijding van het Wortelaaltje (*Heterodera radicicola*, Greef).** [Trials with some Chemicals in the Control of *H. radicicola*, Greef.]—*Meded. R. Hoogere Land-, Tuin- en Boschbouwschool, Wageningen*, xii, no. 1, 1917, pp. 46–48.

The damage done by the Nematode, *Heterodera radicicola*, Greef, in 1915 led to experiments in control being undertaken in the following year with a number of chemicals, of which a combination of lime and sulphate of ammonia (kalk en zwavelzure ammoniak) appeared to be the best, as evidenced by the condition of tomato-plants grown in pots which were used for the tests. A handful of unslaked lime was first mixed with the soil and then 10 grammes of dry sulphate of ammonia added. The pot was subsequently well watered.

GROENEWEGE (J.). **Bestrijding van Insectenplagen van het Suikerriet door Schimmels en Bacteriën.** [The Control of Insect Pests of Sugar-Cane by Fungi and Bacteria.]—*Meded. Proefstation de Java-Suikerindustrie, Soerabaia*, vi, no. 18, 1916, 11 pp.

The author doubts the economic importance attributed by some nvestigators to fungi and bacteria in the control of insect pests.

In the case of sugar-cane pests, Gough and Rorer were the first to employ such means, using *Metarrhizium anisopliae* against *Tomaspis saccharina* (*varia*) in Trinidad. Spraying with the spores proved useless, but strewing the fields with rice infected with the spores caused death among a large number of the froghoppers, amounting in some cases to 50 per cent. In Hawaii Speare used *Entomophthora pseudococci* and *Aspergillus parasiticus* against *Pseudococcus calceolariae*, but both proved unsuccessful. Speare recorded *M. anisopliae* as infesting *Rhabdocnemis obscurus, Adoretus umbrosus* and *Anomala orientalis*. Under the most favourable laboratory conditions the first-named was parasitised to the extent of 10–40 per cent.

The author's experiments with *M. anisopliae* in Java in 1914 did not promise to be of much practical value. An account is given of his observations on bacterial infections in the larvae of *Adoretus*, one of the two bacteria concerned being *Bacterium prodigiosum* and the other a new species, *B. gigas*. While these undoubtedly parasitise the larvae under certain conditions, their practical importance seems negligible.

Leefmans (S.). **De Pisangmot,** *Notarcha* (*Nacoleia*) *octasema*, **Meyrick, en hare Bestrijding.** [The Pisang Moth, *Nacoleia octasema*, Meyr., and its Control.]—*Meded. Laboratorium v. Plantenziekten, Batavia*, no. 23, 1916, 22 pp. 5 plates.

Complaints of the scabby appearance of bananas imported into Australia from Java led to the injury being traced to the caterpillar of a Pyralid moth identified as *Nacoleia octasema*, Meyr., by the Imperial Bureau of Entomology, which has also received the same species from Queensland.

The eggs are deposited in heaps. The incubation period was found to be four days during very dry weather at the close of the east monsoon, the maximum number of eggs laid by a single female being 80. The newly-hatched caterpillars usually live between the fruits close to the stem of the bunch and become full-grown in 12 days. Pupation appears to take place on the ground, among dry leaves, etc., in slender cocoons, the pupal stage lasting from 10 to 12 days. In the dry season (east monsoon) the time required by a generation is about 30 days, and in the wet season (west monsoon) about 27 days. The wild food-plants are unknown, nor have any traces of injury been noticed on wild bananas. In Java the only parasite is an undetermined Braconid.

Successful control was effected by dusting the banana bunches, when just opening, with 1 part pyrethrum powder and 3 parts finely sifted ashes, or preferably 3 parts powdered lime. Dusting must be done twice while the bunch develops. In untreated bunches 44–47 per cent. of the fruit was sound ; this figure was 56–69 per cent. in bunches treated once and 80–87 per cent. in bunches treated twice. Both tobacco dust and powdered unslaked lime proved ineffective. Though Paris green (1 part to 19 parts lime) was more efficacious than pyrethrum, it very often caused black spots to appear on the fruit. The cost of the pyrethrum for treating 100 bunches twice was about one shilling, that of the lime being negligible.

Shepherd (F. R.). **Notes on the Destruction of Cotton Bushes by Burning.**—*Agric. Jl. India, Calcutta,* xii, pt. 1, January 1917, pp. 120–121.

The general custom in India has been to destroy by burning cotton plants which are heavily infested by the leaf-blister mite [*Eriophyes gossypii*] and black scale [*Saissetia nigra* ?], when successive crops are to be grown on the same land. The experiment of burying them in as green manure has been tried with excellent results; the new crops have not been infested with the mite when the old plants have been pulled up instead of being cut down, provided that this is done 6 or 8 weeks before planting the new cotton.

Mercet (R. G.). *Aphycus hesperidum,* **sp. n., an Ectophagous Parasite on the Cochineal of Citrus Fruits,** *Chrysomphalus dictyospermi,* **in Spain.**—*Internat. Rev. Science & Practice Agric., Mthly. Bull. Agric. Intell. & Pl. Dis., Rome,* vii, no. 10, October 1916, p. 1555. (Abstract from *Revista de la Real Academia de Ciencias exactas, fisicas, y naturales de Madrid, Madrid,* xiv, no. 11, pp. 776–788, 5 figs.) [Received 4th May 1917.]

The Chalcidid, *Aphycus hesperidum,* sp. n., which is described in this paper, has been found parasitising *Chrysomphalus dictyospermi* on orange trees, laurels and oleanders in Spain [see this *Review,* Ser. A, v, p. 248]. Other natural enemies of *C. dictyospermi* recorded are *Aphelinus chrysomphali, Prospaltella lounsburyi,* and the Coccinellid, *Chilocorus bipustulatus.*

Hugues (A.). **Birds in the Vineyards in the Region of Nîmes.**—*Internat. Rev. Science & Practice Agric., Mthly. Bull. Agric. Intell. & Pl. Dis., Rome,* vii, no. 10, October 1916, p. 1556. (Abstract from *Comptes Rendus Séances Acad. d'Agric. France, Paris,* ii, no. 17, pp. 504–508, 1916.) [Received 4th May 1917.]

None of the birds in the vineyards of lower Provence are really harmful to the grapes, while a great many feed upon insects and for that reason should be protected. The beneficial species include *Cuculus canorus* and *Parus major,* which are especially useful as they destroy the woolly caterpillars of *Arctia caja,* L., and the night-jar, *Caprimulgus europaeus,* which destroys many moths.

Guillochon (L.). **Concerning the Fruit Fly** (*Ceratitis capitata*) **in Tunis.**—*Internat. Rev. Science & Practice Agric., Mthly. Bull. Agric. Intell. & Pl. Dis., Rome,* vii, no. 10, October 1916, pp. 1562–1563. (Abstract from *Comptes Rendus Séances Acad. d'Agric. France, Paris,* ii, no. 16, 1916, pp. 473–477.) [Received 4th May 1917.]

This paper records the author's observations on *Ceratitis capitata* in an experimental garden in Tunis. Larvae were abundant in July and August on peaches, apricots and persimmon, and in August, September and October on pears and apples. In December and January oranges were attacked. Experiments with fruits attached to the trees and smeared with honey to act as traps were unsuccessful, as also were traps containing a solution of colophony in alcohol and castor oil. On growing fruit the larvae collect in the mesocarp near the stone, and in oranges in the spaces round the seeds. Recorded

parasites of *C. capitata* are *Galesus silvestrii*, *Dirhinus giffardi*, *Opius humilis*, and *Syntomosphyrum indicum*.

Moll (F.). **Ueber die Zerstörung von verarbeitetem Holz durch Käfer und den Schutz dagegen.** [The Destruction of worked Timber by Beetles and its Protection.]—*Naturwiss. Zeitschr. f. Forst- u. Landwirtschaft, Stuttgart*, xiv, no. 10–11, October-November 1916, pp. 482–503. [Received 1st May 1917.]

This paper completes previous communications on wood-destroying insects in general (Nat. Ztschr. f. Land-u. Forstwissenschaft, 1912), and on termites (Zentralblatt f. d. Ges. Forstwesen, 1916). These papers deal with pests of worked timber, to which they cause considerable damage; this is not the case with beetles, which are practically unimportant as regards constructional timber, though the injury they do to furniture, etc., is more serious.

The beetles in question are *Hylotrupes* (*Callidium*) *bajulus*, L., *Anobium striatum*, Ol., *A. pertinax*, L., *Xestobium rufovillosum*, De G., *Ernobius mollis*, L., and *Ptilinus pectinicornis*, L. A key to these species is given. Of less importance are *Lymexylon navale*, *Anobium carpini*, *Ptilinus fuscus* (*costatus*), *Bostrychus* (*Apate*) *capucinus* and *Lyctus unipunctatus*.

The chief damage is done during the larval period, which lasts at least one year, often two or more, while the adult rarely lives for more than one or two weeks. As it is important to recognise the larvae, a key to them is also given. These beetles resemble each other in their habits and swarm in spring, the eggs being deposited near the old flight-hole. On hatching, the larva at once begins to burrow. *Ernobius mollis* prefers the bark, while the other species attack the wood, especially the sap-wood. No explanation has yet been found for the fact that the heart-wood is avoided. When nearing maturity, the larva bores towards the surface and pupates, this stage lasting two to three weeks. Some species of *Anobium*, such as *A. pertinax*, and *X. rufus* require a much longer period, which may extend to a year or more. The Anobiid beetles always fly back to their bore-hole. This accounts for the numbers of small beetles found in infested wood. *Anobium striatum*, Oliv., occurs throughout northern Europe and attacks all European timbers, especially pine, fir and oak. Except at the actual pairing time, in June and July, it is rarely seen outside the timber. The eggs are deposited in small heaps in splits in the bark or in the bore-holes. *A. pertinax*, L., has the same distribution and attacks the same timbers as *A. striatum*. Succeeding generations of this beetle live in the same piece of wood, which they hollow out. *Xestobium rufovillosum*, De G., occurs almost exclusively in the timber of deciduous trees, especially beech and oak. It is chiefly found in carpenters' timber and, more rarely, in furniture. The larval passages, which follow the grain, measure up to four millimetres in diameter. The balls of excreta are one of the surest means of recognising this species; they are remarkably large, being nearly one millimetre in diameter, and are flat and lens-shaped. The duration of the life-cycle is not known; it probably lasts two years, after which the adult passes a winter inside the wood until the spring. *Ernobius mollis*, L., infests coniferous woods, its occurrence in deciduous timber being

doubtful. Constructional timber is chiefly attacked when still unbarked. The swarming and pairing period is more prolonged than in any other species. Indoors this beetle is met with almost throughout the year, from spring to autumn. The eggs are deposited beneath the bark or in fissures. The pupal stage lasts about 14 days and complete development occupies about one year. *E. mollis* differs from the other Anobiids in the shortness of its galleries and is remarkable in that it lacks the habit of tapping, by which the sexes of the other species attract one another. *Ptilinus pectinicornis*, L., appears to be less frequently met with than the other species. Both in England and Germany it causes much injury to furniture. It chiefly infests the wood of deciduous trees, such as the oak and the beech, but also attacks conifers. Swarming takes place in early summer, the insects passing most of their lives in the mines, which they do not leave even for pairing. The larval stage lasts about a year, while the pupal stage takes from a few days to three weeks.

As destroyers of constructional timber the Anobiid beetles have little economic importance, so that buildings are not likely to be endangered by them. In furniture, objects of art, etc., their injury may be very serious. Panelling is apt to suffer much; the carvings of Grinling Gibbons in many old buildings in England have been damaged in this manner. In cases where infestation is still slight it is easy to destroy the insects and further trouble may be obviated by adopting preventive measures. *Lymexylon navale* has occasionally appeared in oak in shipyards; some years ago *Ernobius mollis* destroyed forestry exhibits at Eberswalde and Tharandt; *Bostrychus capucinus* has been found in barrel staves and parquet flooring and in chestnut wood; *Lyctus* has caused great damage in carpenters' shops. The only known instance of considerable architectural injury by Anobiid beetles is that of the roof of the principal church at Altona.

As regards preventive control, little is known of natural enemies. The larvae of the Clerid beetles, *Opilo domesticus*, *O. mollis*, *Corynetes coeruleus* and *Tillus elongatus*, prey on those of the Anobiids, while the adults attack the adults. No practical importance can be attached to the use of certain supposedly immune timbers as systematic investigations on this point are lacking. The practice of ringing trees before felling is useless as a preventive of injury. The treatment of cut timber with various protective substances has not yet been thoroughly worked out, but tar oil and its derivatives, such as carbol and phenol, are of undoubted value, and may, if purified and diluted, be used for protecting furniture and other articles. Fumigation with hydrocyanic acid gas has proved the best method, where it can be safely used. For household use carbon tetrachloride may be employed for fumigating or washing the infested articles. Where burrows have to be filled in, paraffin wax is the best substance to use.

KRAUSSE (A.). *Wolffiella ruforum* **m., nov. gen. nov. spec., ein neuer Chalcidier aus den Eiern von** *Lophyrus rufus*. [*Wolffiella ruforum*, gen. et sp. n., a new Chalcid from the eggs of *Lophyrus*.]—*Zeitschr. f. Forst- u. Jagdwesen, Berlin*, il, no. 1, January 1917, pp. 26–35, 25 figs. [Received 1st May 1917.]

This paper records a new Chalcid, *Wolffiella ruforum* bred from eggs of *Lophyrus rufus* deposited on pine needles collected in East Prussia.

SPEYER (E. R.). **Tea Diseases. The Shot-hole Borer Investigation.**—*Trop. Agric., Peradeniya,* xlviii, no. 3, March 1917, pp. 152–155. [Received 1st May 1917.]

This paper contains extracts from a preliminary report on the shot-hole borer of tea, *Xyleborus* (*Anisandrus*) *fornicatus*, Eichh. The female beetle alone constructs a branched gallery, the entrance hole of which constitutes the exit hole for the offspring when the latter have attained maturity. The average time that elapses between the entrance of the female beetle until the emergence of the adult of the next brood is about 60 days. The female dies in the gallery after emergence of the offspring. The average number of young found in one gallery is 15. Four to six generations occur in one year, development being less rapid in the wet season than in the dry. No definite period of hibernation or aestivation has been traced. The insect occurs up to an elevation of 4,800 feet in tea and 5,000 feet in castor-oil plants, the development being slower at the higher elevations. The female beetle, while boring, does not eat the wood excavated, but while constructing the gallery deposits the spores of a fungus on the gallery walls. This fungus gives rise to spores that provide food for the larvae; neither the larvae nor the young adult beetles excavate or feed on any of the tissues of the plant. The damage done to the trees in the process of boring is considerable. In the thinner branches the presence of a horizontal circular gallery between the pith and cambium causes the branches to break easily. While constructing the gallery, the salivary juice of the female beetle causes a disturbance in the tissues, leading to a staining of the wood and an abnormal deposition of what is probably calcium carbonate in the tissues; rotting of the wood follows, causing much damage. The excavation also causes a formation of wood to fill up the gallery; this growth should normally go to the production of leaf. Shade is no check on the ravages of the borer. Two insects predaceous on *X. fornicatus* are a species of thrips and a Trogositid beetle, but neither is sufficiently numerous to be an efficient check.

Experiments have shown that pruning causes a physiological condition in the trees which renders them for a time immune from attack. Later, generally about two to four months after pruning, the borers begin to return from adjoining fields which have out-grown their immunity or from bushes where the beetle can live through periods closely following pruning, and the infestation then increases rapidly until the time of pruning recurs. Various treatments of the prunings have been tried. If the prunings are buried, the borer continues to live and breed in them for at least two months, and can emerge through earth nine inches deep and even deeper. The application of lime, basic slag and sulphate of potash to the buried prunings has no effect on the borer. Sodium bisulphide and potassium cyanide kill the insects in prunings, but these substances are costly and dangerous to handle. As the borer can live in prunings left on the ground, the woody parts should be destroyed within two days of pruning. The practice of burning prunings is not found to have an appreciable effect in controlling the beetle, while valuable organic matter is lost by this method. When disturbed by pruning, the insects do not leave the plant, but push their way as far as possible into their

galleries. Cultivation and soil with a high nitrogen content have a great effect in checking the increase of this borer and green manure and lime dressings are therefore recommended. *Erythrina*, *Albizzia*, *Tephrosia*, *Crotalaria* and *Grevillea* are all attacked by the borer.

Jungle belts have been recommended between adjoining estates [see this *Review*, Ser. A, v, p. 102]. The trees suitable for this purpose are *Acacia decurrens*, for high elevations; red gum, blue gum and toona for medium elevations; rubber and coconut for low elevations. The undergrowth should consist of jungle shrubs, mana-grass, etc. A patana belt three quarters of a mile wide has been found to keep one field isolated from another for several years. Belts of castor-oil plants cannot be planted as traps, as they mature at various times and the insects established in an early maturing plant on emergence would be likely to fly back to the tea.

HENRY (G. M.). **Tea Tortrix** (*Homona coffearia*, **Nietn.**).—*Trop. Agric., Peradeniya*, xlviii, no. 3, March 1917, pp. 159–160. [Received 1st May 1917.]

On hatching from the egg, which usually occurs in about six days, the young larva of *Homona coffearia* wanders actively about for a time and finally settles down, generally on the underside of a mature leaf, spins a silken-covered way at the sides of the mid-rib and feeds on the epidermis of the leaf.

The usual method of combating this moth is the collection of the egg-masses; this method has been in use since 1903. Trapping with lamps has been tried, but without much success. Dead branches of *Grevillea* with foliage were found to attract female moths when hung on sticks just above the tea. Hessian bags were slipped over these branches and the moths shaken from them into the bags. In this way as many as 200 were taken from one branch, but there is no record as to whether this method is an effective control. Male moths are not attracted to the branches. *H. coffearia* is parasitised by several species of Ichneumonids and Chalcids and a bacterial disease frequently kills off large numbers. A minute Hymenopterous parasite has recently been bred from the egg-masses and experiments are now being carried out to determine whether this egg-parasite occurs in any numbers or can be successfully bred in captivity for distribution.

Protection des Cultures contre les Parasites d'importation. [Protection of Crops against imported Pests.]—*Revue Hortic. de l'Algérie, Algiers*, xxi, no. 2, February 1917, pp. 25–29. (From *Feuille d'Informations du Ministère de l'Agriculture*, October 1916). [Received 1st May 1917.]

The rapid increase in the amount of living plants imported from one country to another has introduced a new danger, in that pests of all sorts, particularly insects, are liable to be brought into a country in which they have not previously existed, and to become acclimatised there, frequently seeming to acquire a fresh stimulus to development, either owing to the change of climate or to the fact that their natural enemies do not exist in the new environment. Some of the classical

examples of this are cited. Algeria has been invaded in this manner by pests imported from France, such as the woolly apple aphis (*Eriosoma lanigerum*), the red scale (*Chrysomphalus minor*), etc.

The usual preventive measures against such importations are reviewed, together with a detailed description of fumigation of imported stock by hydrocyanic acid gas, as practised in Algeria, the United States and elsewhere. The formula recommended for its preparation is: cyanide of potassium, 98 per cent., 1 part; sulphuric acid, 66° Bé. 1 part; water, 3 parts.

Kelly (E. O. G.). **The Green-bug (*Toxoptera graminum*, Rond.) Outbreak of 1916.**—*Jl. Econ. Entom., Concord, N. H.*, x, no. 2, April 1917, pp. 233–248.

This paper reviews the various outbreaks of *Toxoptera graminum*, Rond., during the years 1908–1915. America suffered from four disastrous outbreaks of this pest, in 1890, 1901, 1907 and 1916. Investigation has shown that this Aphid is present in the fields in more or less abundance at all times and is ready to increase with the slightest favourable opportunity. The most important factor in its increase seems to be favourable weather conditions and these appear to be a mild, wet autumn, productive of much self-sown wheat, and a mild winter, followed by a cold and rainy spring.

The outbreak began in the spring of 1915 and, conditions continuing favourable to the insect, serious infestation during the spring of 1916 became inevitable. Strenuous efforts were made to cope with the threatened invasion; the most hopeful method of control was considered to be by means of parasites, and as *Aphidius testaceipes*, the most abundant parasite of *T. graminum*, was found in great numbers in one field and also occurred scattered over several States many hundreds of thousands of these parasites were collected and liberated in the infested fields. Unfortunately, weather conditions were adverse to the parasites in the fields and their dispersion proceded slowly. Towards the end of May the Aphids were so numerous that the air seemed full of them and street lights were dimmed by them. The general direction of flight was always with the wind. Many of the winged forms carried larvae of *A. testaceipes.* At the end of May and through early June the weather became warm and dry. The Aphids, having devastated some 600,000 acres of oats and 300,000 acres of wheat in Kansas and Oklahoma, had used up their preferred food-plants and the wingless forms, being unable to travel far enough to reach uninfested fields, succumbed, while the winged forms became dispersed among other host-plants, chiefly maize and kafir corn.

Parks (T. H.). **A County-wide Survey to determine the Effect of Time of Seeding and Presence of Volunteer Wheat upon the Extent of Damage by the Hessian Fly.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 2, April 1917, pp. 249–253.

During the year 1916 an extensive survey was conducted in Kansas in connection with the Hessian fly, *Mayetiola destructor.* The entomologists of Kansas Experiment Station have always advocated four conditions for successful wheat-growing, namely, thorough preparation of the seed-bed, destruction of self-sown wheat, sowing

after the fly-free date and co-operation amongst growers. The records of various fields examined are tabulated with regard to compliance with these conditions. The figures given show clearly that the degree of infestation by the spring brood depends directly upon the amount of self-sown wheat present at seeding time, and the importance of destroying this cannot be over-emphasised. Sowing after the fly-free date undoubtedly proved an important factor in control, though 23 per cent. of the fields included in the survey escaped with slight injury in spite of having been sown before the fly-free date, and after having been heavily infested in the autumn and consequently producing a large part of the spring brood which damaged wheat throughout the county. The burning of stubble appears to have but little importance as a factor in control.

Hayes (W. P.). **Studies on the Life-history of** *Ligyrus gibbosus*, **De G. (Coleoptera).**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 2, April 1917, pp. 253–261, 1 plate.

This paper contains additional information with regard to the life-history of *Ligyrus gibbosus*, about which little has previously been published [see this *Review*, Ser. A, iv, p. 284]. A table is given showing the length of the various stages, each of which is described. Adults that have hibernated are found as early as 4th May and oviposition begins towards the end of the month. The larvae hatch in about 10 days and have been found feeding on the roots of maize, oats and wheat. They also thrive in soils that are rich in decaying organic matter, such as pasture land and freshly manured fields. In rearing cages, the larvae were frequently observed to devour each other. All stages of the beetle are found in the soil, but adults are attracted to lights at night. Natural enemies of the beetle are the common toad (*Bufo americana*), and certain birds. Three species of Sarcophagid flies, *Sarcophaga helicis*, *S. cimbicis* and *S. rudis*, have been bred from dead adults. The grubs are attacked by two distinct bacterial diseases.

No satisfactory method of control can be given for this species. The host-plants are numerous, the adults attacking potatoes, sunflowers, dahlias, sugar-beet, oak, carrot, cotton, maize, parsnip, celery and elm, while the larvae attack pigweed, sunflower, wheat, maize and oats. Autumn ploughing is useless unless undertaken early enough to break up the pupal cells, for the adults, when disturbed, can easily dig into the loosened soil again. It is advisable not to plant maize in freshly broken pasture land, in view of the preference of both grubs and beetles for this kind of soil.

Smith (H. S.). **On the Life-history and Successful Introduction into the United States of the Sicilian Mealy-bug Parasite.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 2, April 1917, pp. 262–268, 2 plates.

The successful introduction of *Paraleptomastix abnormis*, Gir., a Chalcidoid parasite of *Pseudococcus citri*, into the Californian orchards as a control of the mealy bug, has already been recorded [see this *Review*, Ser. A, iv, p. 51]. This paper describes the various stages of the life-history of the parasite and the methods of rearing and colonising it. The younger stages of the mealy bug are preferred as hosts, the newly emerged adult depositing eggs immediately into the

host's body. The pupal stage is passed within the dead skin of the mealy bug, whence the adult issues, the entire life-cycle occupying from 25 to 45 days. *Pseudococcus bakeri* and *P. sacchari* are occasional of the parasite.

The most convenient way of rearing this and other parasites of *P. citri* in the laboratory has been found to be the use of infested green lemons or potato sprouts. For the latter method, shallow trays are filled with a layer of potatoes, the interspaces being filled with moist sand, and are kept in the dark until the potatoes sprout. Mealy bugs are then introduced and breed rapidly. When new host-material is required in any breeding cage, the older tray is placed on the lower shelf with the fresh tray above. In this way all the parasites which may occur on the old tray as young larvae or pupae within the mealy bugs are retained. The process of shifting the trays downward as each fresh tray is added is continued until all parasites have reached maturity, when the older material is discarded. By this method, thousands of parasites have been produced daily. For transmission to field colonies, they are placed in a glass cylinder with a cork at one end into which is inserted an 8 mm. glass tube which projects into the cylinder and prevents the escape of the parasites. The cylinder is filled with finely shredded paper on which the insects can rest. When liberated the cylinder is tied to a tree and the cork removed. About five to ten thousand insects constitute a colony.

The economic importance of *Paraleptomastix abnormis* lies in the fact that it fills a gap in the natural control of the mealy bug, as there is no other parasite in California which effectively destroys the first and second stages of the insect. Its adaptation to environmental conditions is almost perfect and it has proved able to survive fumigation carried out against scale-insects, probably passing this period as larvae and pupae within the young mealy bugs. Spraying does not destroy it. Its introduction therefore seems an important step towards control of this citrus pest.

Hyslop (J. A.). **Notes on an introduced Weevil** (*Ceuthorrhynchus marginatus*, **Payk.**).—*Jl. Econ. Entom., Concord, N. H.*, x, no. 2, April 1917, pp. 278–282, 1 fig.

Ceuthorrhynchus marginatus, Payk., appears to have been established on dandelion in the eastern States for some years without having attracted much attention. The larvae are to be found in the flower-heads just prior to their throwing off the withered petals. When the seed-heads open, the larvae crawl out, drop to the ground and burrow down at the base of the plant about half an inch below the surface, where they construct small, oval earthen cells in which they pupate. The larvae feed principally on the seed, but on several occasions were found on the withered flower-petals. By the first of July all the adults had emerged. On the 20th October adult beetles were to be found under the litter at the base of dandelion plants and these insects undoubtedly hibernate as adults. As the insect can destroy about one-quarter of the seed of a noxious weed, it is an important economic factor. The dandelion, however, is now being extensively used as a green vegetable in certain parts of the country, and there this weevil, when abundant, would therefore constitute a crop pest.

CHITTENDEN (F. H.). **The Two-banded Fungus Beetle.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 2, April 1917, pp. 282–287, 1 fig.

The Tenebrionid beetle, *Alphitophagus bifasciatus*, Say, though now cosmopolitan, would appear to be native to America, though its origin is doubtful. This beetle has been observed in flour, maize meal, bread, and under bark and decaying wood and other vegetable matter, including dried fruit and fungi. A certain degree of moisture is necessary for its development. In rearing jars a new generation was produced in 32 days on fermenting meal and flour. Allowing six days for the probable period of the egg-stage, the larval period apparently lasts three or four weeks in summer, the pupal period occupying six days during hot August weather. In buildings, Persian insect powder was found to be an effective control. In granaries and places where stored materials are kept the beetles succumb to standard remedies such as fumigation and heat. The insect is not a serious pest in buildings where clean conditions are maintained.

HEADLEE (T. H.). **Further Trial of Sulphur-Arsenate of Lead Dust against the Strawberry Weevil.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 2, April 1917, pp. 287–290.

The success of sulphur mixed with arsenate of lead dust as a protection from the strawberry weevil, *Anthonomus signatus*, Say, and the value of this method over other control measures, has already been recorded [see this *Review*, Ser. A, iv, p. 189]. This mixture acts as a repellent only, very few of the weevils being killed by the treatment. The results of the applications in 1915 were so surprising that further tests were planned for 1916, and tables are given showing the results of treatment with arsenate of lead and flour, arsenate of lead only, sulphur only, sulphur and lead 1 : 1 and sulphur and lead 1 : 5. Traction or power machinery was found necessary in dealing with large areas; on small areas applications through a cheese-cloth bag or with the hand only gave good results. A mixture of the two substances was found to be far more effectual than either used alone, probably owing to its better flowing qualities. The 1 : 5 mixture proved as successful as the 1 : 1, and much less expensive. The increase in crop obtained by the treatment was about 200 per cent. and, provided that a complete coating of the buds is maintained during the critical period, even better results should be attained.

DAVIDSON (W. H.). **Little known Western Plant Lice.**—*Jl. Econ. Entom., Concord, N.H.*, x. no. 2, April 1917, pp. 290–297, 1 fig.

This paper is a continuation of a previous one [see this *Review*, Ser. A, iii, p. 686].

What is now believed to be *Vacuna dryophila*, Schrank, has already been described by the author in the apterous vivipara and young sexual forms under the name of *Chaitophorus* sp. [see this *Review*, Ser. A, ii, p. 251]. Examination of other forms has since led to the conclusion that this species is widely separated from *Chaitophorus*. The stem-mothers of *V. dryophila* hatch about the beginning of March and feed at the base of the oak buds, producing a generation of young which become apterous viviparae and give birth to the third generation.

Some of the third generation become nymphs and later acquire wings. The second generation matures early in April and the third at the beginning of May. The nymphal form is described and compared with European examples. The spring colonies are much attended by ants and are largely preyed upon by natural enemies. After May, only the young sexual forms that are deposited by the alatae of the third generation remain. The spring colonies feed both on the stalks and on the lower leaf surface, but the sexual forms only on the latter; these latter do not mature until late in November. The adults are described from specimens taken from the valley oak (*Quercus lobata*). A species is found in California on alder (*Alnus rhombifolia*) which apparently belongs to the same group of Aphids, and of which only the oviparous form has yet been taken.

Callipterinella annulata, Koch, of which *Chaitophorus betulae*, Buckt., is treated as a synonym, has a wide distribution in America. In California it occurs on imported birch (*Betula alba*). The oviparous forms are described.

Aphis neo-mexicana, Ckll., var. *pacifica*, nov., has been found in California causing curling of the terminal leaves of cultivated red currants. The alate and apterous viviparous female forms are described.

Stem-mothers of *Myzus ribifolii*, sp. n., were found on wild flowering currant (*Ribes glutinosum*), causing curling and blistering of the foliage, similar to the injury caused by *Myzus ribis*. Descriptions are given of the various forms. These Aphids are not found after the month of May; presumably the winter eggs are deposited in this month and do not hatch until the following spring. Mature individuals of the second generation have been collected at the end of March; the stem-mothers would therefore appear to hatch as early as February.

An Illustration of the Importance of Quarantine against Injurious Insects.—*Jl. Econ. Entom., Concord, N.H.*, x, no. 2, April 1917, p. 298.

The cotton belt of Brazil, which was pronounced in 1914 after thorough examination to be free of the boll weevil (*Anthonomus grandis*) and the pink bollworm (*Gelechia gossypiella*), was found in 1916 to be thoroughly infested with the latter pest. The method of introduction was obviously due to the large quantities of cotton seed shipped to Brazil from Egypt in consequence of the Brazilian Government's agitation in 1913 for the cultivation of Egyptian cotton. This seed was introduced and disseminated throughout Brazil without fumigation or any other treatment and the consequent infestation has been so heavy that the Government is now seriously considering the passing of an enactment requiring the burning of all the cotton fields in the Republic.

Controlling the Cottony Cushion Scale in New Orleans.—*Jl. Econ. Entom., Concord, N.H.*, x, no. 2, April 1917, p. 298.

In 1916 a meeting was held in New Orleans to urge a campaign in rearing and distributing the Australian Coccinellid, *Novius cardinalis*, for the control of the cottony cushion scale (*Icerya purchasi*). The

rearing of the beetles had been begun in the summer of 1916, specimens of *N. cardinalis* having been obtained from California and Florida, as well as scales infested with the Agromyzid fly, *Cryptochaetum* (*Lestophonus*) *monophlebi*. Several colonies of the beetle have been started and it is expected that many thousands will be reared.

The Value of Economic Entomology in the War.—*Jl. Econ. Entom., Concord, N.H.*, x, no. 2, pp. 299–300.

The present crisis has accentuated the need for the conservation and development of all resources, many of which, such as life, health and food, have a close relation to applied entomology, and there are great opportunities for the economic entomologist to demonstrate the utility of his calling. The urgent necessity for better sanitation with regard to the insect problem warrants an entomological staff being attached to every large camp and hospital centre to handle with the co-operation of the medical or sanitary corps the problems relating to flies and other disease-carriers, as well as those concerning body parasites and animal pests. The economic entomologist is also needed to advise and urge the adoption of measures which will minimise the effects of insect ravages, especially upon staple crops, and every effort should be made to forecast and where possible forestall insect depredations, rather than to adopt remedial measures after infestation is established, as the entomologist is frequently called upon to do.

Lewis (A. C.) & McLendon (C. A.). **Cotton Variety Tests for Boll-Weevil and Wilt Conditions in Georgia.**—*Georgia State Bd. Entom., Atlanta*, Bull. no. 46, January 1917, pp. 34. [Received 2nd May 1917.]

This bulletin contains much information useful to cotton growers as to varieties of cotton which are most resistant to the boll-weevil (*Anthonomus grandis*) and wilt disease. Tables are given showing the results of tests with different varieties. The weevils begin to emerge early in the spring and feed first on the buds of the cotton and later on the squares. The buds that become blackened after the attack should be picked off, as well as the squares that become yellow, while those that fall to the ground should be collected and burnt once a week until about the middle of July. As a rule the boll-weevil is not sufficiently numerous in the field until August to destroy all the squares that appear. In the absence of sufficient squares, the matured bolls are attacked; hence the necessity for selecting a variety that will continue to fruit until late in the season.

Williams (J. W.). **How to grow Cotton in Spite of the Boll Weevil.**—*Georgia State Bd. Entom., Atlanta*, Bull. no. 47, February 1917, 48 pp., 9 plates. [Received 2nd May 1917.]

This bulletin outlines plans for growing cotton by methods that secure the best conditions and the maximum results in the presence of the boll-weevil (*Anthonomus grandis*). Emphasis is laid on the necessity for destroying cotton stalks in the autumn as soon as the cotton is harvested. This reduces the number of weevils that live

through the winter. The ground should be thoroughly prepared in the autumn and harrowed two or three times during the winter. No cover crop should be planted before cotton. When the weevil first appears, the colonies should be stamped out when possible by killing the weevils and taking up the first plants that show infestation.

FRYER (J. C. F.) & PETHERBRIDGE (F. R.). **Reports on Further Investigations on the Capsids which attack Apples.**—*Jl. Bd. Agric., London*, xxiv, no. 1, April 1917, pp. 33–44, 1 plate.

This paper supplements a previous one [see this *Review*, Ser. A, iv, p. 107] and records a number of spraying experiments conducted with the object of determining the best control for Capsid bugs. One of the difficulties in connection with spraying is that the period during which the bugs hatch and that of the blossoming of apples may to some extent coincide. These investigations confirm the former conclusions that the most serious pests are *Plesiocoris rugicollis* and *Orthotylus marginalis*, which are almost indistinguishable in their early stages, while the bugs of the genera *Psallus* and *Atractotomus* are of secondary importance and almost harmless. These bugs must be regarded as a definite pest of both black and red currants, as well as of apples, while they have been known to attack willows that were actually touching the branches of an apple tree, the latter remaining almost neglected. This choice of various food-plants points to the probability of a still further increase in the activities of these pests.

Experiments with various spraying mixtures showed that nicotine, even when highly diluted, is fatal to the bugs, provided they can be thoroughly wetted with the spray, and is the best insecticide to use. It may be applied in conjunction with soap, lime-sulphur or Bordeaux mixture, the choice depending on local conditions. Nicotine is often objected to on the ground of expense, but the results of the experiments under review justified its use. The highest proportion of marketable fruit was obtained from a plot sprayed with nicotine, 3 oz., soft soap, 4 lb., water, 40 gals. A mixture of lime-sulphur (sp. g. 1.3), 1 gal., nicotine, $2\frac{1}{2}$ oz., and water, 40 gals., also gave good results, but did not kill the bugs so quickly. The chief difficulty in spraying is to reach the insects that shelter in the trusses, under leaves, or between leaves that have been spun together by winter moth larvae. Emphasis is laid on the fact that the gain from spraying cannot be judged in Capsid attacks even by a thorough examination of sprayed and unsprayed plots; in the present instance only a very slight advantage was observable in the nicotine-sprayed plots and it was not until the apples were picked and graded that the importance of the nicotine spray as a control was proved.

MATSUMURA (S.) & ADACHI (J.). **Synopsis of the Economic Syrphidae of Japan.**—*Entom. Magazine, Kyoto, Japan*, ii, no. 4, February 1917, pp. 133–152. [Received 3rd May 1917.]

In this paper, which is a continuation of a previous one [see this *Review*, Ser. A, iv, p. 335], some new genera of Syrphids are erected and some new species described, but their economic relations are not given.

El Gusano Chupador de la Caña de Azucar. [The Sugar-cane Borer.]—*Revista Agricola, Bogotá,* ii, no. 12, December 1916, pp. 728–729. [Received 3rd May 1917.]

The Pyralid, *Diatraea saccharalis,* F. (*obliteratellus,* Zell.), is recorded as being the principal pest of the sugar-cane crop in the northern provinces of Argentina.

De Bergevin (E.). **Remarques à propos des Galles provoquées sur le *Tamarix articulata* par l'*Eriophyes tlaiae* Trabut.** [Remarks on the Galls caused by *Eriophyes tlaiae* **on** *Tamarix articulata.*]—*Bull. Soc. Hist. Nat. Afr. Nord, Algiers,* viii, no. 4, 15th April 1917, pp. 94–95.

The galls, which are caused by the mite, *Eriophyes tlaiae,* have been found to contain large numbers of a species of *Triphleps,* an Anthocorid bug. These bugs must be regarded as injurious, since they live largely on the juices of plants and destroy *E. tlaiae,* the galls of which possess a commercial value.

Burkill (I. H.). ***Scolia erratica,* Smith, a Parasite of the Red Coconut-Weevil** (*Rhyncophorus ferrugineus*).—*Gardens' Bull. Straits Settlements, Singapore,* i, no. 11–12, 31st March 1917, pp. 399–400. [Received 4th May 1917.]

The wasp, *Scolia erratica,* which is distributed throughout Sikkim, Burma, Tenassarim, Sumatra and Java, may be regarded as a beneficial insect, since it preys on the grubs of the red weevil (*Rhynchophorus ferrugineus*) and black rhinoceros beetle (*Oryctes*), both of which attack coconut palms.

Houser (J. S.). **Two destructive Fall Caterpillars.**—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster,* i, no. 10, October 1916, pp. 297–303, 6 figs. [Received 5th May 1917.]

The caterpillars here dealt with are the walnut datana, *Datana integerrima,* and the yellow-necked apple caterpillar, or apple datana, *Datana ministra,* which attack walnut and apple trees during late summer and early autumn in all parts of the State of Ohio. They are hatched from eggs laid in clusters on the undersides of leaves and are gregarious.

Black walnuts, especially solitary trees, are often killed through successive annual defoliations by *D. integerrima,* and the butternut, hickory, beech, oak, willow, honey-locust, thorn and apple also suffer severely.

The apple is not the only tree attacked by *D. ministra,* the caterpillars of which thrive on pear, peach, cherry, oak, linden, chestnut and beech, often stripping the branch of its foliage and leaving nothing but the petioles. The red-humped apple caterpillar (*Schizura concinna*) also attacks apple trees in this way.

There are three methods of control suited to different stages of growth. Young clusters of larvae may be stripped from the branch by hand, and crushed, burned, or killed in vessels of water and kerosene. The mass of sluggish, moulting caterpillars can be removed

from the trunk and lower limbs of trees, and destroyed by crushing, scalding, or burning. This method cannot be depended on, as on large trees the caterpillars often moult out of reach.

When the larvae are plentiful and attacks occur annually, spraying with poison gives the best result. Arsenate of lead paste, at the rate of 3 to 5 pounds to 50 U.S. gallons of water, or $1\frac{1}{2}$ to $2\frac{1}{2}$ pounds of powdered arsenate to the same quantity of water is the best spray, and is most effective if used as soon as the caterpillars appear.

JARVIS (E.). **The Cane-Beetle.**—*Queensland Agric. Jl., Brisbane,* **vii, no. 3, March 1917, pp. 140–142.** [Received 7th May 1917.]

Further investigations carried out on 14 successive evenings between the 15th November and 28th December on the nocturnal habits of *Lepidiota albohirta* showed that, contrary to previous conclusions, the beetles were attracted by artificial light before daylight had quite disappeared. The light used was an acetylene lamp of 21 litres capacity, and the observations lasted from 6 till 10 p.m. It was found that early in the season (15th to 25th November) flight lasted from 7 till 7.20 p.m., but that in December it lasted from 7.20 till 8 p.m. Further, the aerial activity varied with the temperature, being greatest when the temperature was above 80° F., and not lower than 75° F., while below 65° flight ceased altogether and the beetles became torpid. Another factor which powerfully affected the duration of flight was the amount of moisture present in the ground. On 21st November, seven days after the first appearance of this beetle, it was on the wing for 25 minutes only, the temperature being 76°. On 23rd November at a temperature of 78°, and on the 25th at 75°, not a single beetle appeared on the wing. These conditions, however, did not affect *Anomala antiqua* (*australasiae*), a smaller cane-beetle which appeared in large numbers.

The primary emergence of *Lepidiota frenchi* took place on the 13th and 14th December after a heavy rainfall. This species occurs practically throughout open forest country, its larvae subsisting on the roots of grasses and various herbaceous plants and frequently attacking sugar-cane. Flight begins suddenly upon the first approach of twilight (6.45 p.m. on the occasion observed) and lasts for about 10 minutes. A weedy condition of the plantation leads to infestation by this beetle, but, unfortunately, canes on perfectly clean land have also afforded specimens of its eggs and newly-hatched grubs among the main roots.

Important laboratory experiments have been instituted to determine the effect of different stomach poisons on very young larvae of *L. albohirta,* the results of which will be recorded in due course.

The Cotton-Boll Worm. *Queensland Agric. Jl., Brisbane,* **vii, no. 3, March 1917, p. 142.** [Received 7th May 1917.]

In August 1916 a method was suggested in this journal for protecting cotton-bolls from the Pyralid moth, *Dichocrosis punctiferalis,* which occurs in India, the Eastern Archipelago, Australia, etc., by planting alternate rows of cotton and maize or cow-peas. This was followed by a communication from the Assistant Director of Agriculture in the

Sudan to the effect that the spiny boll-worm (*Earias insulana*), the red boll-worm (*Diparopsis castanea*) and the pink boll-worm (*Gelechia Gossypiella*) had never, to his knowledge, been known to attack either maize or cowpeas in the Sudan, but confine their attention to cotton or other malvaceous plants.

The Government Entomologist, Mr. H. Tryon, now reports that the method has definitely been found to be unsatisfactory, observation having shown that the growing maize will attract this moth to places where it has not previously occurred and that it will then attack cotton and maize alike, the former being damaged when otherwise it might escape injury.

Alfieri (A.). **Catalogue des Cerambycides de l'Egypte.** [Catalogue of the Cerambycids of Egypt.]—*Bull. Soc. Entom. d'Eggpte, Cairo*, ix, part 3, July-September 1916, pp. 63–76. [Received 11th May 1917.]

This catalogue contains a list of the species which may be considered as forming part of the Egyptian fauna, and also of those species which have been introduced into the country, chiefly owing to the importations of forest trees. Only a few of the species mentioned are of economic importance; those causing considerable damage include *Xystrocera globosa*, which has largely contributed to the destruction of *Albizzia lebbek* in the streets of Cairo, and *Macrotoma palmata*, which attacks *Acacia nilotica*, tamarisk, willow, camphor, sycamore, plane, etc.

Thomas (A. P. W.). **The Grass-grub Pest.**—*New Zealand Dept. Agric., Indust. and Commerce, Wellington*, Bull. no. 27, January 1913, 14 pp. [Received 14th May 1917.]

The grass-grubs which are widely distributed in New Zealand, and which seem to be increasing their destructiveness, comprise several species of *Odontria*. The chief injury to grasses and cereals is caused by *O. zealandica*, but *O. xanthosticta* has been found in widely separated localities, and *O. brunnea* also occurs. *O. zealandica* matures in November, laying its eggs soon after, while *O. xanthosticta*, and possibly other species of grass-grubs, mature and lay their eggs at the end of summer and in early autumn. The beetles remain in the ground during the daytime, but fly at night for a short distance, and then settle on some plant and feed on the foliage. Among trees, plum and rose trees seem to be preferred food-plants; strawberry-plants and apple-trees are also attacked. While feeding, the beetles are easily captured by shaking from the trees. By lighting fires on evenings when the beetles are swarming, great numbers are attracted and killed by flying over the fires. Whether the life-cycle of the grubs is completed in one year is as yet uncertain. During a spring investigation of wheat-fields, grass-grubs of two distinct sizes were found, the larger ones apparently being the larvae of a second season's growth. Various methods for controlling the grubs have been tried with some success. Rolling pasture lands with a heavy roller destroys a small proportion; in arable land the grubs can be dealt with by ploughing and keeping the land fallow for a sufficient time to starve them. Changing the

crop affords some protection. Birds, particularly starlings, are very useful in controlling the grubs. When the adults are feeding, a spray of Paris green is efficacious in destroying them.

Jepson (F. P.). **Report on a Visit to the Rewa River Plantations.**—*Dept. Agric., Fiji, Suva.* Pamphlet no. 25, 1916, 4 pp. [Received 15th May 1917.]

The banana borer (*Cosmopolites sordidus*) was found to be less prevalent than it had been three years previously, its comparative absence in 1916 being probably due to an exceptionally wet season. Among the conditions that conduce to the spread of this pest are: poor drainage; neglect in planting only clean and healthy suckers; the planting of bananas on the same land for many successive years without a change of crop, or leaving the same crop in the ground too long without replanting; neglect of thorough cultivation before the first planting; planting too close; leaving on the ground or ploughing in borer-infested stems and stumps. Scale-insects were found to some extent on every estate inspected. The best time for spraying is from September to March, during which time the insects are dormant. The only species found on bananas during this visit was *Aspidiotus destructor* Mask. (*transparens*, Green). A small leaf-moth and a fruit-piercing moth were also observed, but as fruit for export is always cut green, the presence of the latter was not important.

The coconut-leaf moth (*Levuana iridescens*) was prevalent in most districts, but the trees attacked were in isolated positions. The coconut-leaf miner (*Promecotheca reichei*) was found in two localities, though probably present in most districts, and was also found destroying the foliage of the ornamental palm, *Livistona* sp. *Aspidiotus destructor* was found on coconut leaves, but was not plentiful.

A new undertaking, that of rubber-planting, has been begun, and the rubber seems to be remarkably free from insect attack except for one case of leaf-miner, and on another estate a little scale infestation. Species of Coccids identified were *Chionaspis dubia*, Mask., on maiden hair fern, *C. citri*, Comst., on *Caladium* sp., *Aspidiotus destructor* on avocada pear, popple-nut, papaw, and ginger.

An unsuccessful search was made for the Histerid beetle (*Plaesius javanus*) introduced three years previously [see this *Review*, Ser. A, ii, p. 507; iv, p. 53] but, as its development is slow and very prolonged and its habits are entirely nocturnal, the failure to locate it is not considered surprising.

Ehrhorn (E. H.). **Division of Plant Inspection.**—*Hawaiian Forester and Agriculturist, Honolulu,* xiv, nos. 2 & 3, February & March 1917, pp. 41–42 & 67–68. [Received 16th May 1917.]

During the month of January, a package of walnuts from Korea was intercepted and destroyed, as the nuts were infested by the larvae of a moth.

In February, a Coccid (*Phenacoccus azaleae*) was found on azalea from Japan. In the soil round a *Thuya* tree from Japan were found 24 weevil larvae, a few ants and an earwig.

Fullaway (D. T.). **Division of Entomology.**—*Hawaiian Forester & Agriculturist, Honolulu,* xiv, nos. 2 & 3, February & March 1917, pp. 43 & 69–70. [Received 16th May 1917.]

During the month of January the following parasites were reared and distributed: *Opius fletcheri* (melon fly parasite), 1,442 females and 1,138 males; 400 *Tetrastichus*; 63 *Galesus silvestrii*; and 6,511 corn leaf-hopper egg-parasites. There is now definite proof of the establishment of the melon fly parasite in Hawaii, the parasites having been recovered several times from infested wild cucurbitaceous fruits.

During February the insectary produced and distributed 985 females and 675 males of *Opius fletcheri*; 250 *Dirhinus*; 200 *Tetrastichus*; 195 females and 77 males of *Dirhinus tryoni*; 60 females and 45 males of *Opius humilis*; and 2,275 corn leaf-hopper egg-parasites.

Allen (A. A.). **The Warblers.**—*Amer. Forestry, Washington, D.C.,* xxiii, no. 280, April 1917, pp. 221–225, 10 figs.

The economic importance of the migratory warblers in forests and woodlands in the United States is very great and the necessity for legislation to protect them can hardly be over-emphasised. One palm-warbler was observed to catch insects at the rate of from 40–60 a minute during a space of four hours, making a total of nearly 9,500, while another species feeding upon Aphids on a grey birch destroyed 89 in a minute and 3,500 in 40 minutes. The destruction of caterpillars is on the same scale, one warbler destroying 22 gipsy moth (*Lymantria dispar*) caterpillars in 14 minutes, another 28 browntail (*Euproctis chrysorrhoea*) caterpillars in 12 minutes, and a third 42 in 30 minutes.

Levison (J. J.). **Spraying Work of this Season.**—*Amer. Forestry, Washington, D.C.,* xxiii, no. 280, April 1917, pp. 236–238, 3 figs.

The advice given for spraying in May is as follows:—(1) For scale insects such as the oyster-shell scale [*Lepidosaphes ulmi*] and scurfy scale [*Chionaspis furfura*], either spray while the tree is dormant with kerosene emulsion at the rate of 1 gallon to 10 gallons of water, or later, after the young have emerged, with 1 gallon to 25 of water. In the case of scalecide, 1 gallon to 15 gallons of water should be used before the buds open, and 1 to 40 afterwards. If fish-oil soap is used, it should be at the rate of 1 pound to 10 U.S. gallons of water. (2) For red spider and Aphids, 1 pound of fish-oil soap to 5 U.S. gallons of water may be used for evergreens and the underside of leaves of beech and Norway maples. (3) For leaf-eating insects such as the elm leaf beetle [*Galerucella luteola*] and the caterpillars of the tussock moth [*Hemerocampa*] spray with arsenate of lead at the rate of 1 pound to 12 U.S. gallons of water.

The tulip scale [*Toumeyella liriodendri*] should be removed with a coarse hair brush, the insects being collected and burnt. The infested branches should then be washed with a solution of soap and water, or kerosene emulsion, 1 part to 10 parts of water.

«Журналъ Прикладной Энтомологіи.» —[*Journal of Applied Entomology*], *Kiev*, vol. 1, no. 1, 1917, xx & 114 pp., 23 figs. [Received 10th May 1917.]

This is the first part of a new journal published by the Russian Association of Workers in Applied Entomology, the Editors being V. V. Dobrovliansky, I. V. Emelianov and A. G. Lebedev. The Association came into existence as a result of a resolution to that effect passed by the Kiev Entomological Congress in 1913 [see this *Review*, Ser. A, iii, p. 245] and the inaugural meeting was held in Kiev in November 1915. The object of the Association is to promote the progress of Applied Entomology in Russia.

The journal will comprise original articles on Applied Entomology and Zoology and an index of the Russian literature on Applied Entomology will be issued yearly, as a supplement. Among the papers read at the first meeting were: "The methods of ascertaining moisture in thermostats," by I. V. Emelianov [see this *Review*, Ser. A, iv, p. 169], and "The rearing of *Trichogramma semblidis*, Aur., and *T. fasciatum*, Perk., in the laboratory and temperature experiments on them," by A. P. Bragina [see this *Review*, Ser. A, v, p. 155].

Mokrzecki (S. A.) & Bragina (A. P.). **Вырожденіе непарнаго шелкопряда въ Крыму.** [The Disappearance of *Lymantria dispar* in the Crimea.]—**«Журналъ Прикладной Энтомологіи.»** [*Journal of Applied Entomology*], *Kiev*, vol. 1, no. 1, 1917, pp. 21–22.

A large outbreak of *Lymantria dispar* occurred in the Crimea in 1913, but in 1914 the pest practically disappeared. The reasons for this were:—the presence of parasites, principally Tachinids, which destroyed some 30 per cent, an epidemic disease resembling flacherie which destroyed another 10 per cent., and the shortage of food due to the great numbers of caterpillars which totally defoliated the trees; the pupae and adults were consequently of very small size and the majority of the adult moths were males. Whereas the females bred under normal food conditions contain up to 1,200 eggs, those from localities suffering from a shortage of food contained only from 60 to 200, and the less food there was in a given locality the greater the percentage of males reared in it.

Vitkovsky (N. N.). **Стеблевая совка въ Екатеринославской губерніи въ 1915 г.** [*Oria musculosa* Hb. in the Govt. of Ekaterinoslav in 1915.]—**«Журналъ Прикладной Энтомологіи.»** [*Journal of Applied Entomology*], *Kiev*, vol. 1, no. 1, 1917, pp. 22–23.

The outbreaks of *Oria musculosa*, which have taken place in the government of Ekaterinoslav and in South Russia generally since 1910, reached their maximum in 1914 [see this *Review*, Ser. A, iii, p. 110]. In 1915 the development of this moth was principally checked by a Braconid parasite.

RIMSKY-KORSAKOV (M.). **Къ біологіи водныхъ наѣздниковъ.** [On the Biology of parasitic aquatic Hymenoptera.]—**«Журналъ Прикладной Энтомологіи.»** [*Journal of Applied Entomology*], *Kiev*, vol. 1, no. 1, 1917, pp. 1–7.

Parasitic Hymenoptera living in water possess some practical importance as being enemies of certain voracious aquatic insects that prey on fish fry. In addition to some Braconids and Chalcids, they include a number of minute species of the family MYMARIDAE, parasitic in the eggs of different insects. The author's observations on these were carried out in parts of Russia and Finland and also in South Germany.

The most common species found in most ponds, ditches, etc., is *Prestwichia aquatica*, Lubb. This insect winters in the larval stage in the eggs of various Dytiscid beetles, deposited in the stems of water plants. In the north the adults emerge in May; they are able to swim by means of their legs and also to jump with the aid of their wings, but do not fly. In dry tubes they die in a few hours, while in moist air they are able to live several days. In May they oviposit in the eggs of larger beetles, such as *Dytiscus* and *Cybister*, 50 or more eggs being laid in each egg of the host. The larvae hatch in 2–4 days, the larval stage lasting 8–15 days and the pupal stage 12–15 days. The adults remain for one or two days inside the egg during which time pairing occurs. The adult life outside the eggs continues for 10–15 days. The second generation appears at the end of June or beginning of July. This generation oviposits again in the eggs of other Dytiscids, the eggs available at that time being those of *Acilius*, *Agabus* and other smaller species; from 8–15 larvae of the parasite breed in each of these. A third generation appears in July and a partial fourth one in August.

The females are dimorphic, some of them having rudimentary wings like the males. As a rule the females emerging from one egg are all of one form, especially in those bred from the smaller eggs. From the larger eggs both forms emerge, which is due to the fact that several females oviposit in them. Another species parasitising the eggs of *Dytiscus*, is *Anaphes cinctus*, Hal. (*Polynema natans*, Lubb.). It is less common than *Prestwichia* and little is known about it. A third species, *Anagrus subfuscus*, Forst., parasitises the eggs of dragonflies of the genera *Agrion*, *Lestes* and *Calopteryx*. Only one parasite occurs in each egg. This species is less adapted to life in water and is very active, jumping, and even flying, in the air. Several other species, not yet identified, were also observed and reared.

TARNANI (Prof. I. K.). **Организація наблюденій надъ жизнью майскаго жука при постоянной Комиссіи по лѣсному опытному дѣлу.** [The Organisation of Observations on the Biology of *Melolontha* by the Permanent Commission on Forest Experimental Work.]—**«Журналъ Прикладной Энтомологіи.»** [*Journal of Applied Entomology*], *Kiev*, vol. 1, no. 1, 1917, pp. 8–21.

The author was deputed in 1911 by the Forestry Department to investigate the infestation of the forests of the governments of Tambov, Vladimir, and Samara by larvae of *Melolontha*. These were found

to be present in great numbers, though the whole of the damage could not be attributed to them, as they were always accompanied by larvae of other species, such as *Amphimallus solstitialis*, L., etc. A simple way of distinguishing between living larvae of *Melolontha* and those of *Amphimallus*, *Phyllopertha*, *Anomala*, *Serica*, *Anisoplia*, etc., is to place them on a hard smooth surface, when the former are unable to get on their feet and remain lying on their sides, while all the others can move away.

As a result of the author's investigations, the Forestry Department decided to establish several experimental forestries in the governments of Vladimir, Tambov, Kiev, Kazan and others for the proper study of this pest and its control. Some reports on the work done have already been dealt with [see this *Review*, Ser. A, ii, p. 11 ; iii, p. 728 ; iv, p. 101]. Although much still remains to be done and the work of the experimental forestries has been hampered for various reasons, the results accomplished are of much importance. The digging operations are conducted on definite lines, the holes made being combined into groups, numbered and entered on a map and in a book : a great number of them have already been dug and they will in time cover the whole of the forests and thus afford means of ascertaining the number of larvae present in the soil and the foci of infestation. While in the government of Lublin in Poland the larvae of *M. hippocastani* concentrate in open and drier spots, they tend to seek the cover of the woods in some of the southern governments. Their distribution also depends on the topographical features and the character of the soil, the larvae preferring low-lying ground. The larvae of *Polyphylla fullo*, L., on the contrary, prefer open and elevated ground. As regards *Melolontha melolontha*, it has been ascertained that in those places where it is present together with *M. hippocastani*, its larvae occur in fields and along the boundaries of forests, while the larvae of the latter are found in the forests. All these larvae readily eat the leaves of birch, oak and other trees, which fact may be of practical importance in using poisoned baits and also shows that living larvae may be transported in leaves as well as in soil. It is also probable that, in cases of scarcity of roots, the larvae, particularly in spring, when they are near the surface of the soil, feed on leaves of *Potentilla*, *Verbascum* and similar plants, the leaves of which grow close to the ground. For purposes of oviposition the females avoid sandy or ploughed ground, which has no lumps or similar objects against which they can press their heads, when digging themselves in. This points to reploughing and cultivation as a means of control.

Both *M. melolontha* and *M. hippocastani* have a four years' cycle in the government of Lublin, the flying years having been : 1895, 1899, 1903, 1907, 1911 and 1915, the next one being expected in 1919 ; in Tambov, Vladimir and Kazan, *M. hippocastani* has a five years' cycle, 1917 being a flying year. Experiments have shown that larvae of *Melolontha* can live in water for 18 days and the adults 12 days, the larvae of *A. solstitialis* for 15 days, and those of *P. fullo for* 11 days, indicating that flooding is useless. The enemies of cockchafers observed included the predaceous larvae of ASILIDAE, which devour both the eggs and young larvae, and the parasitic larvae of *Tiphia*, *Scolia*, *Dexia* and *Mintho praeceps*, the percentage of infestation by

these parasites being however small. The larvae of a Tachinid fly were found in the adults of *P. fullo*; in one forest this parasite was found in 56 per cent. of the females and 7 per cent. of the males.

Experiments were made with carbon bisulphide, carbon tetrachloride, barium chloride, tobacco dust and various baits. The latter consisted of black soil alone or mixed with dung in holes in sandy ground. Up to the present, however, hand collection is still regarded as the most effective remedy. A table is given showing the results of a chemical analysis of the contents of dried specimens of *M. hippocastani* and it is recommended that the collected insects should be put to a practical use as food for cattle, poultry or fish.

Goriainov (A.). **О массово-статистическомъ методѣ.** [On the Statistical Method in Entomological Work.]—**«Журналъ Прикладной Энтомологіи.»** [*Journal of Applied Entomology*], *Kiev*, vol. 1, no. 1, 1917, pp. 22–37.

In this somewhat technical paper, the author discusses the possibilities and limitations of the application of this method in applied entomology.

Kulagin (Prof. N. M.). **О подготовкѣ спеціалистовъ по прикладной энтомологіи.** [On the Training of Experts in Applied Entomology.]—**«Журналъ Прикладной Энтомологіи.»** [*Journal of Applied Entomology*], *Kiev*, vol. 1, no. 1, 1917, pp. 38–43.

The existing provision for the training of experts in applied entomology in the agricultural high schools and universities in Russia is not regarded as sufficient, and the author advocates the establishment of special courses. These should be open in the first instance to those who have already had some training in natural or agricultural science. A syllabus of the proposed courses is given.

Zvierezomb-Zubkovsky (E.). **Нѣсколько словъ о насѣкомыхъ, гнѣздящихся въ подпольяхъ зернохранилищъ.** [A few Words on Insects underneath the Floor of Grain-stores.]—**«Журналъ Прикладной Энтомологіи.»** [*Journal of Applied Entomology*], *Kiev*, vol. 1, no. 1, 1917, pp. 44–46.

A list is given of insects which were found in more or less large numbers underneath the floor of grain stores and railway sheds. These include:—*Calandra granaria*, L., *Tenebrio molitor*, L. (found rarely), *T. obscurus*, F. (much more common), *Tribolium confusum*, Duv., *Silvanus surinamensis*, L., *Laemophloeus ferrugineus*, Steph., *L. testaceus*, L., *Ptinus fur*, L. (in large numbers), *Alphitophagus bifasciatus*, Say, *Alphitobius piceus*, Oliv. (very common), *Blaps lethifera*, Marsh., *Monotoma quadrifoveolata*, Aub., *Cryptophagus* sp. ?, *Enicmus* sp. ?, *Mycetaea hirta*, Marsh., *Anobium domesticum*, L., *Attagenus piceus*, Oliv., *Anthrenus museorum*, L., *Phyllodrepa plana*, F. ?, *Dendrophilus punctatus*, Hrbst., *Ephestia kühniella*, Zell., *Sitotroga cerealella*, Oliv., *Tinea granella*, L., *Lyctocoris campestris*, F., also larvae and pupae of a fly, probably *Scenopinus* sp. All these insects breed in the grain which gets underneath the floor, and these spaces ought to be cleaned, disinfected with freshly slaked lime and dried every year before the new grain is brought in.

Bielsky (B. I.). **Къ біологіи** *Opomyza florum* F.—**вредителя озимыхъ хлѣбовъ.** [On the Biology of *Opomyza florum*, a Pest of Winter Cereals.]—**«Журналъ Прикладной Энтомологіи.»** [*Journal of Applied Entomology*], *Kiev*, vol. 1, no. 1, 1917, pp. 47–76.

The author discovered larvae of *Opomyza florum*, F., in the stems of winter grain crops in Kiev in 1914 and the fly was also found in the same year by I. I. Korab in another locality of that government. The identification of this pest was confirmed by the late I. A. Portchinsky, who pointed out the scarcity of records concerning it. *O. florum* is known to occur in Austria, Germany and Belgium ; in Russia it has been observed in several governments, though no reports of damage by this insect have been received. This in the opinion of the author is due to the fact that the larvae in their first two stages resemble mature larvae of *Oscinella frit*, while the apparent damage is the same. The adults are very sensitive to heat and in the summer remain in or near forests, returning to the fields in the autumn. Pairing and oviposition take place in September ; the eggs are laid in the soil, near the shoots of winter-sown grain. The eggs remain through the winter, but the exact time of the hatching of the larva has not been ascertained. The larvae of the first stage are always found inside the stem at the base, though it is not known how they reach this position ; having moulted, they penetrate into the tube formed by the unfolded leaves at the apex, which turn yellow, thus indicating the presence of this pest. The larvae of the third stage return to the base of the shoot, feeding on the dead and decaying tissues of the plant and destroying the whole of the shoot ; they also pass in this stage to other shoots. Cases have been observed where larvae of *Oscinella frit* present in such shoots were devoured. Pupation takes place inside the destroyed stems near the root. The larvae are found in March, April and May ; the pupal stage lasts 18–22 days ; the adults live about five months from May to October or November. About 11 per cent. of the pupae collected in one estate produced a parasite, not identified. The economic importance of *O. florum* is far less than that of *Hylemyia* (*Leptohylemyia*) *coarctata* as it never destroys the tillering point, as does the latter, but only single stems. If the percentage of infested crops is not higher than 25, the necessity for any remedies is doubtful ; even a greater percentage can be regarded as dangerous only where the soil is poor and exhausted, the only remedy in these cases being the use of proper manure.

Gross-Heim (W. A.). **Инъекція гипсомъ, какъ методъ изученія подземной жизни насѣкомыхъ.** [Injection of Gypsum (Plaster of Paris) as a Method of studying the subterranean Life of Insects.] —**«Журналъ Прикладной Энтомологіи.»** [*Journal of Applied Entomology*], *Kiev*, vol. 1, no. 1, 1917. pp. 77–79.

In order to study the construction of the burrows and mines of insects living underground, such as *Gryllotalpa gryllotalpa* (*vulgaris*), Latr., *Lethrus apterus*, Laxm., etc., the author, in conjunction with I. V. Emelianov, has used injections of plaster of Paris. For this purpose the powder is mixed with water to the consistency of

cream, when it is immediately injected into the burrow so as to fill it entirely. It is left there for several hours, or in case of wet soil, for a day, when it can be dug out, care being taken not to break the mould.

KURDJUMOV (N. V.). **Новый родъ и видъ изъ** Aphelininae (Chalcidoidea). [A new Genus and Species of Aphelininae (Chalcidoidea.] — **«Журналъ Прикладной Энтомологіи.»** [*Journal of Applied Entomology*], *Kiev*, vol. no. 1, 1917, pp. 80–81.

This is a description, in English, of both sexes of *Xana nigra*, gen. et sp. nov., reared at the Agricultural Experimental Station of Poltava from *Eriococcus greeni*, Newst., and by N. A. Grossheim in the Crimea from the puparium of *Leucopis* sp. ?

PLIGINSKY (V. G.). **Еще объ окуриваніи табачнымъ дымомъ.** [Again on Fumigation with Tobacco Smoke.] — **«Журналъ Прикпадной Энтомологіи.»** *Journal of Applied Entomology*], *Kiev*, vol. 1, no. 1, 1917, pp. 82–84.

Fumigation with tobacco dust, usually effected against the adults of *Psylla*, also acts as a preventive, benefiting the crop of the following year. The author has obtained good results in laboratory experiments in fumigating against the nymphs, and his assistant, I. I. Yankin, has used this method with success against the larvae of *Psylla* and Aphids in orchards.

DIMO (N. A.). **Роль и значеніе термитовъ въ жизни почвъ и грунтовъ Туркестана.** [The Rôle and Significance of Termites as regards the Character of the Soil and Ground of Turkestan.]— — **«Русскій Почковѣдъ.»** [*The Russian Geologist.*] 1916, no. 7–10, pp, 153–190, 3 diagrams, 4 tables of figs. (Abstract from **«Журналъ Прикладной Энтомологіи.»** [*Journal of Applied Entomology*], *Kiev*, vol. 1, no. 1, 1917, pp. 95–99.)

The general view recently held by different authorities was that the fauna of deserts is very poor and plays no important part in the formation of the soil in them. This view has undergone a radical change since 1908, when the investigations of the soil in Turkestan and Transcaspia were begun, and it is now recognised that animals burrowing in the ground are important factors in the process of formation of soil.

This article describes the author's observation as regards termites in this connection which were carried out in the Starvation Desert. Province of Samarkand, during 1908–1915.

Five species of termites are known to occur in Turkestan, viz., *Hodotermes turkestanicus*, Jac., *H. vagans septentrionalis*, Jac., *H. angerianus*, Jac., *H. murgabicus*, Vas., and *H. baekmanianus*, Vas., of which the first two are the best known. The effect of these insects on the character of the soil is discussed at length.

Bako (N. J.), Gussev (M. A.) & Miroshnikov (I. A.). **Біологія амбарнаго долгоносика.** [The Biology of *Calandra granaria* L.] — **« Отчетъ о дѣятельности Лабораторіи по испытанію зерна при Отдѣлѣ зернохранилищъ Государственнаго Банка за время съ 1-го Ноября 1913 по 1-ое Января 1915 года.** [*Report on the Work of the Laboratory on the Testing of Grain at the Department of Grainstores of the State Bank from 1st November 1913 to 1st January 1915*], *Petrograd*, 1915, pp. 78–93.—(Abstract from **« Журналъ Прикладной Энтомологіи.»** [*Journal of Applied Entomology*], *Kiev*, vol. 1, no. 1, pp. 99–101.)

This is a report on experiments as to the different kinds of grain in which *Calandra granaria* can breed and on the influence of high temperature on these weevils. Linseed, hempseed and peas are untouched by them, while they are able to breed in millet, sunflower seed, wheat, barley, oats and buckwheat. Wheat proved to be the grain in which the weevils bred most freely, and their numbers increased in it 16 times between 3rd December 1913 and 17th September 1914. Next to wheat came barley, and then oats, for which the corresponding figures were 10 and 2 ; in buckwheat, the increase amounted only to 7 per cent. The amount of grain destroyed of oats, barley and wheat was in the ratio of 1 : 3 : 9. The fact that oats are less damaged is attributed to the nature of the husk, as, when this was removed, they proved to be only slightly less injured than barley and wheat ; the small damage to buckwheat proved to be due to the character of the grain itself. The number of dead beetles bred in grain, from which the husk was removed, was 80 per cent. for buckwheat ; 50 per cent. for oats ; 40 per cent. for barley and 30 per cent. for wheat. It is impossible to give here the corresponding data as regards the effect of heat, as it is not clear whether the temperatures given refer to Celsius or Réaumur.

Vinokurov (G. M.). **Предварительный отчетъ по обслѣдованію вредителей въ Ордубадскомъ районѣ, Эриванской губ. въ 1916 году.** [Preliminary Report on the Investigation of Pests in the Ordubad District of the Govt. of Erivan in 1916.] — **« Извѣстія Тифлисо-Эривано-Карсскаго Бюро борьбы съ вредителями сельскаго хозяйства.»** [*Bulletins of the Tiflis-Erivan-Kars Bureau for the Control of Pests of Agriculture*], *Tiflis*, no. 1. November 1916, pp. 1–18. [Received 21st May 1917.]

This report gives a list of pests including :—*Anthonomus pomorum* L., which destroyed more than half of the crop of apples and pears. about 50 per cent. of the weevils on pear trees being destroyed by a parasite, while other parasites attacked them on apples ; *Cydia pomonella*, L., attacked apples, pears, apricots and walnuts ; *C.* (*Grapholitha*) *funebrana*, Tr., appeared in April on sloes, while the second generation bred in July and August on plums ; *Hyponomeuta malinellus*, Zell., was found on apples and apricots, the adults being on the wing in July in large numbers ; about 50 per cent. of the pupae collected by the author were killed by a Hymenopterous parasite and to a less degree by a Dipteron. An unidentified Lepidopteron injured the flowers of apricots and a Tortricid the leaves of quinces.

Rhynchites giganteus, Kryn., *R. bacchus*, L., and other species attacked apples, pears, plums, peaches, apricots and sloes, especially the last two; *Oxythyrea natalia*, Ols., and *O. cinctella*, Burm., were noticed on flowers of roses and quinces; *Epicometis* (*Tropinota*) *suturalis*, Reitt., *E. senicula*, Men., and *E. hirta*, Poda, injured flowers of late-blossoming apples and quinces; *Capnodis tenebrionis* was found on the trunks of peach trees, of which it is considered to be a pest. *Lachnus persicae*, Chol., was not numerous and was destroyed by Dipterous larvae. Apples were attacked by *Aphis pomi*, DeG., and pears by *A. pyri*, Koch. Pests of poplar trees were *Melasoma* (*Lina*) *populi*, L., and *Phyllorycter* (*Lithocolletis*) *populifoliella*, Tr.

Pests of field crops included *Anisoplia* on wheat and barley, which were also injured by Aphids and thrips; a specimen of the Locustid, *Platycleis vittata*, Charp., was observed to devour grain in an ear of wheat, which tends to show that this family cannot be regarded as harmless to agriculture. Cotton was injured by Aphids, wireworms and caterpillars of *Euxoa*; from caterpillars injuring peas examples of *Heliothis obsoleta*, F. (*armigera*, Hb.) were reared; lucerne was injured by *Sitones* sp., *Apion* sp., *Cephus pygmaeus* and *Adelphocoris* sp.

Iliinsky (A. M.). **Изъ наблюденій надъ вредителями инжира въ Кахетіи.** [Observations on the Pests of *Ficus carica*, L., in Kakhetia.]—**«Извѣстія Тифлисо-Эривано-Карсскаго Бюро борьбы съ вредителями сельскаго хозяйства.»** [*Bulletins of the Tiflis-Erivan-Kars Bureau for the Control of Pests of Agriculture*], *Tiflis*, no. 2, December 1916, 19 pp., 2 tables of figs. [Received 21st May 1917.]

In a short introduction to this work, B.P. Uvarov draws attention to the total absence of data relating to pests of fig-trees in Russian literature, in consequence of which the Entomological Bureau of Tiflis entrusted the author with the investigations on this question in the summer of 1916.

Three species of insects injuring fig trees are described and figured, viz., *Hemerophila* (*Simaethis*) *nemorana*, Hb., *Hypoborus ficus*, Erichs., and *Homotoma ficus*, L.

The first-named is found only in places where fig-trees are grown. The female moths oviposit in the second half of May on the lower side of fig leaves. The habits of the larvae resemble those of the related species, *H.* (*S.*) *pariana*, Cl., on apples. They pupate in from 18 to 20 days, the pupal stage lasting two weeks. The second generation oviposits in the first half of July, the caterpillars produced being much more injurious, as both the fruit and leaves are injured. A third generation of adults appears in the middle of August, and it is thought probable that they may give rise to a third generation of caterpillars in September. The hibernating stage in Kakhetia has not been ascertained. Young fruits, when attacked, drop from the tree and older fruits fail to develop. The best remedy is spraying with Paris green or some other insecticide at the time of the appearance of the caterpillars of the first and second generations. The caterpillars are attacked by an Ichneumonid parasite and by a predaceous Reduviid bug. A fungus disease has also been observed to destroy them.

The beetle, *Hypoborus ficus*, Erichs., is widely spread in Kakhetia. It does not attack fig branches that are quite healthy, probably owing to the poisonous nature of the sap, but only those injured and weakened in some way. The larval mines are at right angles to those of the adult and at the end of them the larva prepares a cell in which it pupates. The removal of all injured branches is advised. The Pysllid, *Homotoma ficus*, L., was found in large numbers on figs at the end of June, in the adult and nymphal stages; it also attacks apples. A scale-insect was found underneath the loose bark of old trees; the larvae of a Cerambycid beetle bores in the smaller branches, and an Aphid attacks the leaves.

UVAROV (B. P.). **Недостатокъ сѣры и ,,чоръ'' хлопчатника.** [The Scarcity of Sulphur and Cotton Diseases.]—Published by the Tiflis-Erivan-Kars Bureau for the Control of Pests of Agriculture, *Tiflis*, no. 9, 4 pp.

This article deals with the control of a disease of cotton seed, known locally under the name of "tchor," and the nature of which is as yet uncertain, though it is thought that *Tetranychus telarius* probably plays an important part in causing it. Reference is made to the work of Parker and McGregor in America which shows that powdering with sulphur is not an effective remedy against *T. telarius*, a better one being a solution of a paste of wheat-flour.

UVAROV (B. P.). **Техника борьбы съ саранчевыми внѣ Россіи.** [The Technique of the Control of Locusts outside of Russia.]—**«Земледѣльческая Газета.»** [*Agricultural Gazette*], *Petrograd*, nos. 8 (176) & 11–12 (179–180), 10 March & 7 April, pp. 176–177 & 226–228.

The author states that, owing to the difficulties of receiving foreign publications and periodicals during the War, this article has been prepared chiefly from information which has appeared on the pages of this *Review*. It is noted that mechanical methods of controlling locusts, now nearly dispensed with in Russia, are still in use in some countries, as also are contact insecticides, such as soap, tar or kerosene emulsion. Spraying with poison insecticides is becoming practically universal and it is claimed that this method has been best studied and worked out in Russia. Of late great progress has also been made in the use of poisoned baits.

UVAROV (B. P.). **Краевое совѣщаніе по борьбѣ съ саранчевыми въ Ташкентѣ.** [Provincial Conference in Tashkent on the Control of Locusts.]—**«Земледѣльческая Газета.»** [*Agricultural Gazette*], *Petrograd*, no. 11–12 (179–180), 7 April 1917, pp. 234–235.

This Conference took place at the beginning of February 1917 in Tashkent. Eggs of *Dociostaurus* (*Stauronotus*) *maroccanus* having been discovered over an area exceeding 270,000 acres, a large outbreak is threatened. It was decided to conduct the campaign principally by means of sprayings and also to make extensive use of poisoned baits, all mechanical methods being rejected. The cost of the campaign is estimated at about £130,000.

The Conference also discussed the future work of controlling these and other pests in the Province, the existing organisation having proved inadequate. It was agreed that it is necessary to establish local bureaus for the control of pests in all the provinces of Turkestan, and that these should be supported from local funds. A provincial conference for the whole of Turkestan should be established as a permanent body to co-ordinate their work. These local bureaus should be relieved from scientific experimental work, which should be carried out by the existing experimental organisations, especially the Turkestan Entomological Station, which it is proposed to re-organise into a station for the protection of plants, consisting of three sections: entomological, phytopathological and zoological.

Watson (J. R.). **Florida Truck and Garden Insects.**—*Univ. Florida Agric. Expt. Sta., Gainesville*, Bull. 134, April 1917, pp. 35–127, 57 figs.

This paper gives a comprehensive survey of the principal insect pests attacking garden crops in Florida and contains useful instructions with regard to general methods of controlling insects; formulae are given for the most usual poison and contact insecticides and the process of fumigation is described.

Bean pests include several species of Jassids, the most abundant being *Empoasca mali* (bean leaf-hopper) for which the controls suggested are strong tobacco extract, kerosene emulsion and the use of hopper-dozers. *Eudamus proteus* (bean leaf-roller) attacks beans planted in early autumn and can be destroyed by a spray of lead arsenate paste 1½ lb. to 50 U.S. gals. water. *Bruchus obtectus* is the most common bean Bruchid, the female ovipositing in growing or dried beans. Beans should be planted in fields in which neither beans nor cow-peas have been recently grown and dried beans should be fumigated or kept in cold storage. The Pyralid, *Elasmopalpus lignosellus*, Zell., tunnels up and down the stem, killing the bean-plant, and is therefore very difficult to control. Infested plants should be pulled up and destroyed. *Ceratoma trifurcata*, Forst. (bean leaf beetle) feeds on the leaves, the larvae attacking the roots. The plants should be sprayed with Bordeaux mixture containing 1 lb. lead arsenate to 50 U.S. gals. of mixture. Lima beans are attacked by the larvae of the Pyralid, *Monoptilota* sp. which form a gall in the stem. No control is known for this pest.

Beets are attacked by blister-beetles, of which the most common are *Epicauta heterodera* and *E. vittata*. The colonies should be sprayed with lead arsenate, or, as the larvae are beneficial in eating the eggs of grasshoppers, the beetles may be driven from the field by whipping the plants with twigs, working with the wind. *Chortophila* (*Pegomyia*) *vicina* (beet leaf-miner) burrows in the leaf-tissues and should be checked by stripping the plant of infested leaves. Minor beet pests include the moths *Celerio lineata*, *Hymenia perspectalis* and *Zinckenia* (*H.*) *fascialis*.

Cabbage, cauliflower and mustard are attacked by the same pests. For cutworms, which gnaw off the young plants just above the ground, poison-baits, such as young green plants dipped in a strong solution of Paris green, or Kansas mixture, should be scattered about the

field after sunset, preferably before the cabbages are planted out. Other Lepidopterous pests include *Phytometra* (*Autographa*) *brassicae* (cabbage looper), *Plutella maculipennis*, *Pieris* (*Pontia*) *rapae*, *Pieris protodice* and *P. monuste*. These can be easily controlled by arsenicals, such as 2 lb. of lead arsenate or zinc arsenite to 50 U.S. gals. water; soap or flour paste should be added to make the mixture adhere to the leaves. Among Aphids, *Myzus persicae*, *Aphis brassicae* and *A. pseudo-brassicae* attack cabbages, and are controlled by a spray of tobacco extract. *Chortophila* (*Phorbia*) *fusciceps* (cabbage root-maggot) is best dealt with by placing some repellent such as tobacco dust about the roots of young plants, or in a badly infested plot carbon bisulphide can be poured from a small spoon into a hole slanting down to the root. Minor pests include *Murgantia histrionica* (harlequin cabbage-bug) and *Mermis albicans* (cabbage hair-worm).

Celery pests include *Lygus pratensis* (tarnished plant-bug), *Nysius angustatus* (false chinch-bug), both controlled by strong tobacco extract and soap, *Papilio polyxenes* (celery caterpillar), *Phytometra* (*Plusia*) *simplex* (celery looper) and *Pionea* (*Phlyctaenia*) *ferrugalis* (celery leaf-tier), and the Aphids, *Myzus persicae* and *Macrosiphum lactucae*.

Grain crops are attacked in Florida by *Heliothis obsoleta* (corn ear-worm), *Carpophilus*, the wireworms *Monocrepidius vespertinus*, *M. lividus*, *Horistonotus uhleri*, *Melanotus* sp., *Lacon curtus* and *L. rectangularis*, *Laphygma frugiperda* (fall army worm), *Crambus* sp., *Sphenophorus* spp., *Agromyza parvicornis* (blotch miner), *Diabrotica* 12-*punctata* (southern corn root-worm), and the weevils, *Calandra oryzae* and *C. granaria*, which attack stored wheat.

Cowpea pests include *Chalcodermus aeneus* (cowpea curculio), which first attacks the leaves of the plant, and later the pods. The insects can be controlled by 1 lb. lead arsenate powder to 50 U.S. gals. of water, while feeding on the leaves early in the season. *Nezara viridula* (pumpkin bug) is a troublesome pest to control. When young, the bugs can be killed by kerosene or strong soap solution, but the adults are best controlled by hand-picking. *Agromyza pusilla* (serpentine leaf-miner) is kept in fair control by parasitic enemies. *Haltica uhleri* (garden flea-hopper) can be controlled by tobacco extract. Bruchid pests include *Bruchus* (*Pachymerus*) *quadrimaculatus* and *B.* (*P.*) *chinensis*; these attack stored peas and should be controlled by fumigation, or by keeping the peas at temperatures below 34° F., for two or three months, which destroys the eggs as well as the adults.

Cucumbers and cantaloup melons are attacked by *Diaphania nitidalis* and *D. hyalinata*; for the former a trap-crop of squash is the best control; the latter can be killed by arsenical sprays. *Diabrotica vittata* (striped cucumber beetle) should be sprayed with lead arsenate.

Egg-plants are attacked by *Myzus persicae* and various plant-bugs. *Dysdercus suturellus* (cotton stainer) can be controlled by strong contact insecticides or by trap-baits. The Spanish cocklebur (*Urena lobata*) is a favourite host-plant of this insect and should be destroyed when growing near crops.

Lettuce is attacked by *Phytometra brassicae*, and by various Aphids, including *Macrosiphum rudbeckiae*; *Empoasca mali* also damages lettuce.

Onions are chiefly damaged by thrips. *Thrips tabaci* is numerous, but is easily controlled by tobacco extract and whale-oil soap.

Parsley is attacked by *Papilio polyxenes* and by cutworms.

Peas are damaged by *Acyrthosiphon* (*Macrosiphum*) *pisi* and in dry weather by the mite, *Tetranychus telarius*, which can be controlled by heavy sprinkling or by sprays of sulphur dust. *Bruchus* (*Laria*) *pisorum* attacks dried peas.

Potato pests include the Coreid, *Acanthocephala femorata*, which attacks early potatoes and is best picked off by hand. It is abundant on thistles, which should not be allowed to grow near a potato crop. *Leptoglossus phyllopus*, *Lachnosterna* sp., and *Ligyrus gibbosus* are minor pests.

Squash plants are attacked by the caterpillars of *Melittia satyriniformis*, which bore into the stem, and by the squash-bug, *Anasa tristis*, for which the most satisfactory control is hand-picking.

Strawberry pests include the Lygaeid, *Pamera vincta*, Say, which causes the berries to wither. This insect is very abundant on wild spurge (*Euphorbia* sp.), which may be its native host-plant; this weed should be destroyed in the vicinity of strawberry beds. *Pamera bilobata* is also found, as well as red spiders, thrips—including *Frankliniella bispinosus projectus* and *Leptothrips mali*, and the bug, *Corimelaena publicaria*, which can be driven away by a spray composed of a tablespoonful of crude carbolic in 2 U.S. gals. water. *Haltica ignita* (flea-beetle), and *Gryllus assimilis* (field-cricket), are minor pests.

Sweet potatoes are attacked by *Prodenia* spp., which should be sprayed with lead arsenate, or surrounded with Kansas bait; *Bemesia inconspicua* causes considerable damage to late crops, the larvae sucking the sap from the leaves. They should be killed, when young, by a strong soap solution or kerosene emulsion. *Cylas formicarius* attacks the roots or stored tubers. All potatoes infested by this weevil should be used only for stock-feeding.

Tomatoes are chiefly damaged by *Heliothis obsoleta*, for the control of which the plants should be sprayed, while the fruit is still very small, with 2 or 3 lb. of lead arsenate or 1 lb. of zinc arsenite to 50 U.S. gals. of water. Maize is recommended as a trap-crop sown between every 10 to 20 rows of tomatoes; this should be timed to have developed young silk when the first tomatoes are ripening and must be cut before it has matured sufficiently to become unattractive to these caterpillars. Minor tomato pests include *Frankliniella bispinosus projectus*, *Protoparce* (*Phlegethontius*) *quinquemaculata* and *P. sexta* (which are largely controlled by *Apanteles congregatus*), *Celerio lineata*, and the whitefly, *Aleurodes tabaci*.

Watermelons are infested by *Aphis gossypii*, for which the suggested controls are spraying with Black-leaf 40 and soap solution, fumigating with tobacco, or dusting with tobacco dust when the young plants are wet with dew, and clean culture.

BRITTON (W. E.) & DAVIS (I. W.). **Controlling the Gipsy and Brown-Tail Moths.**—*16th Rept. State Entomologist of Connecticut for the Year 1916, Conn. Agric. Expt. Sta., New Haven, 1917*, pp. 83–98, **5 plates.** [Received 17th May 1917.]

Recent work by the United States Department of Agriculture having shown that the gipsy-moth [*Lymantria dispar*] is spread

principally by the wind, a most careful examination of wind-swept areas is necessary, special attention being given to oak and apple trees, which are the favourite food-plants. Early in May the bark of trees in and near infested localities may be scraped, provided that the inner bark and the cambium are not injured, and bands of tree-tanglefoot applied to prevent the young caterpillars from crawling up. During June, if the infestation is severe, the young caterpillars may be destroyed by spraying with lead arsenate, 6 lb. in 50 U.S. gals. water.

This report gives details of the above control measures in 21 towns with a table of statistics of infestations. Measures to control the brown-tail moth (*Euproctis chrysorrhoea*) are also recorded, an agent assisted by trained local men having destroyed 14,450 webs in four towns. If the infestations should increase, the establishment of a parasite laboratory would probably be advisable.

BRITTON (W. E.). **A Destructive Aphid on Turnips,** ***Aphis pseudobrassicae*****, Davis.**—*16th Rept. State Entomologist of Connecticut for the Year 1916, Conn. Agric. Expt. Sta., New Haven,* 1917, pp. 98–104, 1 fig., 3 plates. [Received 17th May 1917.]

Aphis pseudobrassicae is widely distributed throughout the United States and is most injurious, completely killing the plants attacked within a few days. It is found on turnip, radish, cabbage, cauliflower, kale, rape, kohl-rabi, rutabaga or Swedish turnip, mustard, lettuce and bean. The fact that it is not found on these cultivated host-plants for four or five months in the year suggests that there is an alternative host, though this has not been identified. In Connecticut natural checks include the Coccinellids, *Coccinella novemnotata*, Hbst., and *C. transversoguttata*, F., which are abundant in both the larval and adult stages. This Aphid is also attacked by the fungus, *Entomophthora aphidis*, Hoff. In Texas *Aphis pseudobrassicae* is heavily parasitised by the Hymenoptera, *Diaeretus rapae*, Curt., and *Lysiphlebus testaceipes*, Cress.

These natural controls cannot, however, be depended on to save the crops, as they appear too late ; reliance must therefore be placed on the destruction of young colonies by spraying the under leaf-surfaces with a solution of common laundry soap, 1 lb. in 7 U.S. gals. of water.

BRITTON (W. E.). **The Control of Aphids in Fields of Seed Beets.**—*16th Rept. State Entomologist of Connecticut for the Year 1916, Conn. Agric. Expt. Sta., New Haven,* 1917, pp. 104–105. [Received 17th May 1917.]

Three species, *Aphis rumicis*, L., *Macrosiphum solanifolii*, Ashm., and *Myzus persicae*, Sulz., are recorded on seed-beets, especially on those plants round the edges of fields. The experimental treatment consisted in carefully spraying the infested part of each plant with Black-leaf 40, 1 teaspoonful in 1 U.S. gal. of water with a little soap added, and an examination of the plants a week or two later showed that it had been, on the whole, effective.

BRITTON (W. E.). **The White-Marked Tussock Moth,** *Hemerocampa leucostigma*, **S. and A.**—*16th Rept. State Entomologist of Connecticut for the Year 1916, Conn. Agric. Expt. Sta., New Haven,* 1917, pp. 105–111, 2 plates. [Received 17th May 1917.]

An account of this pest has already appeared [see this *Review*, Ser. A, v, p. 174], but the following facts may be added. In 1908 it caused serious damage in apple orchards and in 1916 it was reported as feeding on peach and quince trees, though it usually attacks poplar, elm, horse-chestnut, linden, soft maple and other shade trees. In addition to the Hymenopterous parasites mentioned in the former account, Dr. Howard records the following :—*Pimpla inquisitor*, Say, *Chalcis ovata*, Say, *Scambus marginatus*, Prov., *Pimpla annulipes*, Say, *Meteorus communis*, Cress., *M. hyphantriae*, Riley, *Limnerium validum*, Cress., *Theronia fulvescens*, Brull., *Apanteles delicatus*, How., *A. hyphantriae*, Riley, and *A. parorgyiae*, Fitch. Several Dipterous parasites have been reared from the cocoons, including :—*Frontina aletiae*, Riley, *F. frenchi*, Will., *Tachina mella*, Walk., *T. clisiocampae*, Towns., *Euphorocera claripennis*, Mcq., *Exorista griseomicans*, Wulp, *Winthemia quadripustulata*, F., and *Sisyropa* sp.

BRITTON (W. E.). **The Rose Chafer,** *Macrodactylus subspinosus*, **F.**—*16th Rept. State Entomologist of Connecticut for the Year 1916, Conn. Agric. Expt. Sta., New Haven,* 1917, pp. 111–115, 2 plates. [Received 17th May 1917.]

Much of the matter contained in this paper has already been dealt with [see this *Review*, Ser. A, iv, p. 392, and Ser. B, iv, p. 26]. It has been found that the destructiveness of the rose chafer over wide geographical areas varies with the nature of the soil, being greatest in sandy regions, where the insect breeds, and least where the soil is a heavy clay. The grape-vine is particularly liable to attack, the blossoms and newly-set fruit being destroyed. As the insect is attracted by white or light-coloured flowers, the presence of these near vineyards should be guarded against. The newly-set clusters of grapes may be protected by enclosing them in a paper or cloth bag which is pinned tightly round the stem, a method which gives good results in the garden, but is hardly practicable in vineyards. As regards control by cultivation, it has been found that the larvae and adults are very hard to kill, while the pupae are easily destroyed. Hence ploughing and harrowing the ground, or deep cultivation during the last week in May, when the insect is in the pupal stage, is likely to prove efficacious.

BRITTON (W. E.) & LOWRY (Q. S.). **Experiments in controlling the Striped Cucumber Beetle and the Squash Borer.**—*16th Rept. State Entomologist of Connecticut for the Year 1916, Conn. Agric. Expt. Sta., New Haven,* 1917, pp. 116–118, 1 plate. [Received 17th May 1917.]

Field experiments in the control of certain insects attacking Cucurbitaceous plants have been undertaken but so far have only indicated possible lines of treatment, no satisfactory results having been obtained. The striped cucumber beetle, *Diabrotica vittata*, F.,

attacks both cucumbers and squashes early in June and probably the best method of control will be the covering of the plants with protectors, if applied early enough. Arsenical poisoning seems to be more effective when applied in the dry or powdered form than in sprays. The squash borer, *Melittia satyriniformis*, H., which attacks both squashes and pumpkins in August, is probably best dealt with by cutting out the caterpillar and covering the plants with soil.

Britton (W. E.). **The Pine Tip Moth,** *Pinipestis zimmermani*, **Grote.** *16th Rept. State Entomologist of Connecticut for the Year 1916, Conn. Agric. Expt. Sta., New Haven*, 1917, pp. 122–125, 2 plates. [Received 17th May 1917.]

Pinipestis zimmermani together with *Dioryctria abietella*, D. & S., was obtained in the laboratory from sections of pine wood which were under examination for blister rust. It attacks the base of the new annual shoot, causing a brown pitch mass to form and the tip to shrivel and turn brown. It also attacks the trunk and larger branches especially in the vicinity of wounds, often killing small trees. Its larvae are found near the galleries of other borers and are particularly injurious in connection with those of the white pine weevil, *Pissodes strobi*, Peck.

It is known to infest *Pinus strobus* (white pine), *P. rubra*, *P. resinosa* (red or Norway pine), *P. sylvestris* (Scotch pine), *P. cembra* (stone pine), *P. excelsa* (Bhutan or Japanese white pine), *P. austriaca* (Austrian pine), and *P. laricio* (Corsican pine). So far, no practicable method of control is known beyond destroying during the winter or early spring trees or portions of trees known to be infested.

Walden (B. H.). **The Parallel Spittle-Insect on Pine.**—*16th Rept. State Entomologist of Connecticut for the Year 1916, Conn. Agric. Expt. Sta., New Haven*, 1917, pp. 125–126, 1 plate. [Received 17th May 1917.]

The Cercopid, *Aphrophora parallela*, Say, the presence of which is indicated by masses of white froth near the tips of the twigs, is most abundant on pitch pine (*Pinus rigida*), but has also been found on white pine (*P. strobus*), Scotch pine (*P. sylvestris*), and to a less extent on Norway spruce (*Picea excelsa*), but not on Austrian pine (*Pinus austriaca*), red pine (*P. resinosa*), or Jack pine (*P. banksiana*).

Miscellaneous Insect Notes. *16th Rept. State Entomologist of Connecticut for the Year 1916, Conn. Agric. Expt. Sta.. New Haven*, 1917, pp. 138–146, 4 plates. [Received 17th May 1917.]

The scale-insect, *Eriococcus azaleae*, Comst., has been found infesting rhododendrons. The European elm case-bearer, *Coleophora limosipennella*, Dup., is reported from a new district and seems to be spreading; it could probably be controlled by spraying with lead arsenate. Galls caused by *Chermes cooleyi*, Gill., have been noticed on the Colorado blue spruce. Probably a contact spray early in spring would prove a remedial measure, as in the case of *Chermes abietis*, L., the common spruce gall aphis. The Scolytid, *Xyleborus dispar*, F., has been observed on the sugar-maple, in the wood of

which it forms numerous small deep tunnels, as it also does in fruit trees. No remedial method, other than the destruction of the tree, is effective. *Lygus pratensis*, L., the tarnished plant bug, is reported on tobacco. This pest is difficult to control, but a thorough spray of Black-leaf 40, 1 pint in 50 U.S. gals. water, to which has been added 2 lb. laundry soap, should prove effective. Larvae of the green-house leaf-tier, *Pionea* (*Phlyctaenia*) *ferrugalis*, Hb., have been most destructive, feeding on nearly all common vegetables, many native weeds and ornamental herbaceous plants both under glass and out of doors. A good remedy is lead arsenate at the rate of 1 lb. in 10 U.S. gals. water. A flea-beetle, *Oedionychis sexmaculata*, Ill., was found feeding on ash (*Fraxinus*). Where this is grown as a shade tree or for timber, these beetles may become of economic importance. The larvae of the grape-vine sawfly, *Erythraspides pygmaeus*, Say, were found feeding in colonies on the underside of grape leaves. This insect, of which there are two broods each season, can be controlled by spraying with lead arsenate, 3 lb. of the paste in 50 U.S. gals. water. The small moth, *Euclemensia bassettella*, Clem., was bred from a scale-insect, probably *Kermes sassceri*, collected on oak. The hickory-gall aphids, *Phylloxera caryaecaulis*, Fitch, which attacks the new shoots and leaf-stems in June, causes annually an early fall of leaf. Trees would probably be protected from attack if sprayed with kerosene emulsion or nicotine solution when the buds are opening.

SMITH (H. E.). **Notes on New England Tachinidae, with the Description of one New Genus and two new Species.**—*Psyche, Boston, Mass*, xxiv, no. 2, April 1917, pp. 54–58.

Pseudotachinomyia webberi, gen et sp. n., and *Sciasma frontalis*, sp. n., are described. The larvae of *Pelatachina pellucida*, Coq., emerged from the larvae of *Vanessa antiopa*, L., during August, hibernating as pupae through the winter. From 344 Lepidopterous larvae taken in the open, 214 puparia of this Tachinid were obtained. This is apparently the first record of this genus having been reared in North America. *Compsilura concinnata*, Meig., which was introduced into the United States as a parasite of *Lymantria* (*Porthetria*) *dispar*, L., and *Euproctis chrysorrhoea*, L., has been found to be particularly prolific as a parasite of *V. antiopa*. When parasitic on *Callosamia promethea*, it hibernates in the pupa of the host.

WOLCOTT (G. N.). **Report of the Entomologist.**—*Fifth Report Bd. Commiss. Agric. Porto Rico, for the Period from 1st July 1915 to 30th June 1916, Rio Piedras, P.R.*, (1917), 10th August 1916, pp. 75–99, 3 figs. [Received 19th May 1917.]

Entomological work during the year included the inspection of plants, seeds, nursery stock and fruits brought into the port of San Juan, the enforcement of quarantine regulations against insects imported from abroad, and the fumigation of insect-infested nursery stock. A special report on the continuation of white-grub [*Lachnosterna*] investigations will be published later.

For the destruction of scale-insects of citrus trees, eight months' trial has proved that the best spray is an emulsion of whale-oil soap,

8 lb. or 1 U.S. gal., oil (Corvus or Red Junior), 2 gals., and water, 1 gal. The soap is thoroughly dissolved in the water and the oil then slowly added, the mixture being stirred all the time. The stock solution, about 4 U.S. gals., is diluted 1 to 50, making 200 U.S. gals. of spray for use. This spray is slow to take effect and one application is not sufficient to kill all the scale-insects, but it can be used at any time of year without injury and can be mixed with Bordeaux mixture, soluble sulphur against rust mites, or with arsenate of lead. Observations on *Diatraea saccharalis* (moth stalk-borer of sugar-cane) have already proved that its abundance varies inversely with the rainfall, and also that infestation is much greater in fields where the trash has been burnt [see this *Review*, Ser. A, iii, p. 760]. The degree of infestation in various localities is given in tables. *D. saccharalis* was found to occur in greater abundance during the year under review than in the previous year, in spite of heavier rainfall, the reason being that much cane was planted on new land, and under these conditions is always more heavily infested than when grown for the second year on the same land. The trash should not be burnt in fields to be ratooned and seed should be selected in the field where it is cut, any borer-infested seed that is discarded being destroyed immediately.

Flea-beetles infesting tobacco in Porto Rico include *Epitrix cucumeris*, Harr., *E. parvula*, F., *E. fuscata*, Duv., and *Systena basalis*, Duv. *E. cucumeris* is the worst pest, damaging the tobacco crop throughout the year. The eggs are laid in the soil round the roots and hatch in about five days, the young larvae immediately feeding on the roots. The larval stage lasts for 20 to 35 days, the adult beetles emerging about six days after pupation. There are numerous alternate food-plants, many of them growing abundantly near tobacco fields, particularly *Solanum torvum* (wild egg-plant), *S. nigrum* and *Physalis pubescens*. The life-history and habits of *E. parvula* and *E. fuscata* are very similar, other food-plants of *E. parvula* including *Cleome spinosa*, *Leptilon canadense* and *Lycopersicum esculentum* (tomato). Control measures for all these flea-beetles are identical. Weeds and bushes adjacent to tobacco fields should be cut down. Small patches may be left as traps, to be sprayed with Paris green or destroyed by burning when the tobacco crop is harvested. Old tobacco plants should be pulled up immediately after the harvest, in order to destroy the beetles at the roots. The seed beds and young tobacco plants should be kept dusted with a mixture of 3 per cent. Paris green and 97 per cent. corn flour or wood ashes. A spray of 3 or 4 lb. arsenate of lead to 100 U.S. gals. water is efficacious, or the arsenate may be used dry with an equal amount of wood ashes.

Vegetable pests included the larvae of *Xylomeges sunia*, *Protoparce* (*Phlegethontius*) *sexta* and *Phytometra* (*Plusia*) sp. on tomatoes, egg-plants and peppers. The first-named is controlled by a spray of $2\frac{1}{2}$ lb. arsenate of lead to 50 U.S. gals. water. The changa [*Scapteriscus didactylus*] was controlled by surrounding young plants with a ring of mixture composed of 3 per cent. Paris green and 97 per cent. flour rich in gluten. Aphids and lace-bugs on peppers, egg-plant and cucumbers were controlled by a spray of Black-leaf 40, 1 fluid oz. to 8 U.S. gals. water containing $\frac{1}{2}$ lb. whale-oil soap. The Chrysomelid beetle, *Cerotoma ruficornis*, strips the leaves of beans and cowpeas, while the larvae attack the roots. Methods of control are collecting

the beetles in a cheese-cloth net when they first appear, or spraying the plants with 3 lb. arsenate of lead to 50 U.S. gals. of Bordeaux mixture. *Diabrotica graminea*, Baly (green beetle), attacks *Amaranthus spinosus*, bean, beet, sugar-cane, castor-oil bean, maize, cowpeas, cucumbers, egg-plants, and many other plants, the larvae feeding on the roots, while the adult beetles swarm over the foliage and flowers, frequently injuring the pistils and preventing setting of the fruit. The entire life-cycle occupies only about 36 days, the beetles breeding continuously throughout the year. *Cylas formicarius* (sweet potato root-borer) is only abundant in certain localities in Porto Rico. The eggs are deposited in small cavities eaten out of the stalk of potato plants; the larvae on hatching burrow down the stalk to the roots, where they pupate. The life-cycle occupies about a month and the generations are continuous, sometimes destroying an entire crop before the potatoes are ready to harvest. All traces of the old plants remaining after the crop has been gathered should be destroyed by burning and rotation of crops is recommended as a preventive of re-infestation. The grey weevil, *Euscepes* (*Cryptorrhynchus*) *batatae*, has a very similar life-history and should be controlled in the same way.

Muir (F.). **Additions to the Known Philippine Delphacidae (Hemiptera).** —*Philippine Jl. Science, Manila*, xi, Sec. D, no. 6, November 1916, pp. 369–385. [Received 19th May 1917.]

This paper describes 40 species, 15 of which are new. A key to the Philippine species of the genus *Perkinsiella* is given. The importance of this genus lies in the fact that all species at present known live on sugar-cane, which could not be grown over the region of their distribution were they not held in check by parasites. This is specially true of *P. saccharicida*, which was introduced into the Hawaiian Islands, and only controlled by the introduction of parasites. The Philippine species are *P. lineata*, sp. n., on sugar-cane; *P. saccharivora*, sp. n., *P. pseudosinensis*, sp. n., *P. bakeri*, sp. n., on sugar-cane and sorghum; *P. fuscipennis*, sp. n., and *P. vastatrix*, Bred., common on sugar-cane. Other species described are *Stenocranus agamopsyche*, Kirk., on sugar-cane and grasses; *S. pacificus*, Kirk., on grasses; *Eumetopina flavipes*, Muir, on sugar-cane; *Delphax kolophon*, Kirk., *D. eupompe*, Kirk., *D. albicollis*, Motsh., *D. anemonias*, Kirk., and *Peregrinus maidis*, Ashm., one of the commonest leaf-hoppers, the eggs of which are parasitised by a Mymarid (*Paranagrus* sp.) and which might otherwise become a very serious pest of maize.

Oshima (M.). **A Collection of Termites from the Philippine Islands.**—*Philippine Jl. Science, Manila*, xi, Sec. D, no. 6, November 1916, pp. 351–366, 2 plates. [Received 19th May 1917.]

This systematic paper describes 13 species of termites, including four new species, and two species not previously recorded from the Philippines. These are:—*Eutermes gracilis*, sp. n., *E. manilensis*, sp. n., *E.* (*Hospitalitermes*) *hospitalis*, Hav., *E.* (*Hospitalitermes*) *saraiensis*, sp. n., *E.* (*Ceylonitermes*) *macgregori*, sp. n., *Rhinotermes* (*Schedorhinotermes*) *longirostris*, Brau.

Banks (N.). **New Mites, mostly economic (Arach., Acar.).**—*Entom. News, Philadelphia,* xxviii, no. 5, May 1917, pp. 193–199, 2 plates.

Among new genera of mites, or species of economic importance, sent to the United States Bureau of Entomology for determination are the following, which are described in this paper :—the Eupodid, *Notophallus viridis,* sp. n., taken on wheat in Arizona ; *Tetranychus antillarum,* sp. n., on leaves of *Leonotis nepetaefolia* and *Asclepias curassavica* in Porto Rico ; *Tetranobia decepta,* gen. et sp. n., on barley in Arizona ; *Tetranychina apicalis,* gen. et sp. n., on white clover in Louisiana ; *Stigmaeopsis celarius,* gen. et sp. n., found in Florida living in small colonies under dense white webs on leaves of bamboo (*Bambusa metake*).

A key is given to the genera of the family Tetranychidae that occur in the United States. *Tetranychus lotus* and *T. banksi* are placed in a new sub-genus *Eutetranychus.*

Tyroglyphus sacchari, sp. n., has been found in the West Indies on sugar-cane and *Chortoglyphus gracilipes,* sp. n., in tobacco infested with the cigarette beetle (*Lasioderma serricorne*). This is the first record of this genus in the United States.

Howard (L. O.). **Entomology as a National Defence.**—*Entom. News, Philadelphia,* xxviii, no. 5, May 1917, p. 229.

The author points out the importance of the work which entomologists can do in the present crisis in the way of increasing crop production by the control of injurious insects. The United States Bureau of Entomology is organising its forces to disseminate throughout the country essential information of this character by means of publications and the activities of entomologists at field stations, special attention being given to insect outbreaks involving staple crops and to the preservation of stored grain, forage, etc. The Bureau hopes to obtain the co-operation of all crop reporters and farm demonstrators throughout the country, as well as the State and Station entomologists and requests them to keep the central office at Washington advised as to the status of insect pests in their vicinity. The central office will then be able to tabulate and map the occurrence of all injurious pests and indicate the sections which are threatened with insect damage and the means of combating the danger.

Morrill (A. W.). **Report of the Entomologist of the Arizona Commission of Agriculture and Horticulture.**—*Arizona Commiss. Agric. & Hortic. 8th Ann. Rept. for the Year ending 30th June 1916, Phoenix,* 30th December 1916, pp. 11–57, 17 figs., 4 plates.

During the year ended 30th June 1916 nearly 97 per cent. of plant importations inspected were passed as free from insect pests and plant diseases. The following insects were found on imported nursery stock and other plants :—*Coccus hesperidum* (soft brown scale), *Aspidiotus rapax* (*camelliae*) (greedy scale), *Saissetia oleae* (black scale), *Chrysomphalus aonidum* (Florida red scale), *Aulacaspis rosae* (rose scale), *Lepidosaphes beckii* (purple scale), *Aspidiotus hederae* (ivy scale), *Coccus citricola* (grey scale), *Saissetia hemisphaerica* (hemispherical

scale), *Icerya purchasi* (cottony cushion scale), *Hemichionaspis aspidistrae* (aspidistra scale), *Dialeurodes citri* (citrus whitefly), *Aleurodes spiraeoides*, thrips, *Eriosoma lanigerum* (woolly apple aphis) and other Aphids, *Aegeria* (*Sanninoidea*) *exitiosa* (peach borer), unidentified Lepidopterous larvae, tortoise-shell beetle larva (*Cassida* sp.), an undetermined Psyllid, *Tetranychus telarius* (red spider) and *Heterodera radicicola* (root knot). The results of inspection confirmed the view that shipments by parcel post are far more dangerous from the point of view of infection than shipments by freight. Inspections were made of many orchards and nurseries throughout the State, and fruit product inspection resulted in a new form of quarantine notice directed against codling moth. A meeting of plant inspectors approved further quarantine restrictions against the alfalfa weevil, *Hypera variabilis* (*Phytonomus posticus*).

The control of San José scale (*Aspidiotus perniciosus*), codling moth (*Cydia pomonella*) and the date palm scale has been continued. Grasshoppers were unusually abundant and destructive early in the year and were successfully treated with a poison-bait mixture of bran, 25 lb., Paris green, 1 lb., molasses, 2 U.S. qts., and 6 lemons with water to moisten. In some cases 90 per cent. of the grasshoppers were killed in four days. A series of experiments in control of the Chalcid infesting alfalfa seed [*Bruchophagus funebris*] was planned, but the outcome was disappointing and the experiments will be repeated. *Nysius minutus*, Uhl. (false chinch bug) attacked potatoes and flax, its principal source being apparently the pigweed, *Chenopodium album*. On weeds, this insect can be destroyed by blast torches or strong sprays of kerosene emulsion. On vegetable crops nicotine sulphate and whale-oil soap solution is recommended. A galvanised iron collector on the hopperdozer plan was devised and this mechanical method of control proved satisfactory.

Haltica carinata (steel-blue grape-vine flea-beetle), which was abundant in 1915 [see this *Review*, Ser. A, iv, p. 317], was reported only from two localities and caused very little damage. *Harrisina brilliana* (grape-leaf skeletoniser) was unusually abundant. *Harpalus pennsylvanicus* caused considerable injury to strawberries. The larvae of this Carabid beetle feed on other insects and the adults also are frequently beneficial in controlling injurious pests; it is only occasionally that they cause any serious damage by gnawing the fruit to get at the seeds. Bait-traps of meat or sugar and water in basins sunk into the ground have destroyed many similar beetles in England. The most notable instance of insect damage during the year was the extreme abundance of the Nitidulid, *Conotelus mexicanus*, Murr., the adults of which attacked the opening buds of blackberries, peaches, roses, citrus blossoms, and cotton blooms. This damage appears to have been quite abnormal, as the beetle has not previously been reported in large numbers nor as a source of important injury. *Aspidiotus hederae* (ivy scale) was found to be of general occurrence, and must be guarded against as a potential olive pest. *Coccus hesperidum* (soft brown scale), which is a common pest of oleanders, has been kept under fair control by parasites imported from California. The fumigation of citrus orchards with hydrocyanic acid gas is recommended to complete the extermination of this pest. *Scirtothrips citri* continued to infest citrus orchards to about the same extent as before. A red

spider, which was identified as *Tetranychus modestus*, was found infesting maize leaves. These pests first appear in one or more small colonies and at this stage are easily controlled; when unchecked, infestation spreads rapidly, becoming apparent by a slight yellowing along the midrib, gradually spreading all over the blade. A mixture of equal parts of air-slaked lime and flowers of sulphur dusted on with a powder gun proved very effective. Any other fine powder might be substituted for the lime. Maize stalks were also infested with the larvae of a corn-stalk borer, which could not be definitely identified as no adults were obtained, but which was apparently *Diatraea zeacolella*, Dyar. Eggs are deposited on the under-surfaces of leaves, the young larvae beginning to work in the bud. The mature larvae leave the buds and tunnel up and down the lower part of the stalk. The hibernating borers can be destroyed by cutting the stubble low and ploughing it under and burning any refuse that is left on the field. Rotation of crops is also recommended.

Vegetable crop pests included the usual number of grasshoppers and cutworms. A bug, *Pycnoderes quadrimaculatus*, caused considerable injury to lettuce and similar crops; once lettuce is attacked, there is no remedy available. The bugs should not be allowed to breed on weeds or crops of no value and these should be sprayed with a strong solution of crude oil emulsion.

Cotton pests included *Bucculatrix thurberiella* (cotton leaf-miner), which is effectively checked by parasites, the chief being *Arthrolytus aeneoviridis*, Gir., *Smicra* sp. and *Haltichella* sp. The cotton stainer, *Dysdercus albidiventris*, Stål, has unfortunately appeared in Arizona. *D. mimus*, Say, has also been recorded, but not on cotton. Precautions are recommended against allowing the stainer to breed on weeds and plants in the neighbourhood of cotton fields; in the fields the insects should be collected and destroyed wherever possible.

MACKENNA (J.). *Report on the Progress of Agriculture in India for 1915–1916, Calcutta*, pp. 50–56. [Received 20th May 1917.]

Experiments continued at Pusa showed that there are at least five different species of *Rhogas* which parasitise cotton boll-worms [*Earias*] and that these may be a valuable means of control. The Jassid bug known as "maho" [*Nephotettix*], a serious pest of growing rice, was controlled by collection in bag nets. *Nymphula depunctalis*, a caterpillar that feeds on rice plants, was controlled by putting kerosene in the water of the rice fields. Sugar-cane borers include two or more species of *Diatraea*, and these may occasionally attack other cereal crops such as maize, millet, etc., though the normal borers of these are rarely found on sugar-cane. These pests may be controlled by varying the time of planting. To protect cane setts from termites lead arsenate was found to be the best insecticide. Spraying operations were carried out to check the green scale [*Coccus viridis*] on coffee and experiments were made with a parasitic fungus. It was found that the liability of tea bushes to attack by the tea mosquito [*Helopeltis*] can be lessened by the addition of soluble plant foods to the soil. Various insecticides were successfully tried on termites and thrips attacking tea. The European olive fly [*Dacus oleae*] was discovered in wild olives in N.W. India. The lime treatment of stored

grain was found to protect it from all insect pests without impairing its edible qualities, and fumigation of the granaries with carbon bisulphide was successfully carried out. The Noctuid, *Agrotis ypsilon*, on rabi crops was controlled by Andres-Maire traps, and the Arctiid, *Amsacta albistriga*, on millet, was kept in check by hand-picking. Experiments have been made with a view to reviving the silk industry by rearing hybrid silkworms, a cross between the native species that has four or five generation a year, and the Chinese and Japanese species that have only one. These hybrids showed a greater resistance to disease than the native species.

Ebner (R.). **Die sogenannten "japanischen" Heuschrecken unserer Gewächshäuser** (*Diestrammena-Tachycines*). [The so-called Japanese Grasshoppers of our Greenhouses.]—*Centralbl. Bakt., Parasit. u. Infektionskr., Jena,* IIte. Abt., xlv, no. 18–25, 19th June 1916, pp. 587–594. [Received 20th May 1917.]

The greenhouse pest imported from Japan, and known as *Diestrammena marmorata*, de Haan [see this *Review*, Ser. A, v, p. 98], has also been called *D. unicolor*, Br. In 1913 Boldirev identified examples from central Germany with *Tachycines asynamorus*, which was described by Adelung in 1902 from greenhouses in Petrograd. In 1914 both Chopard and Burr identified examples examined by them as belonging to this genus and the author has found that examples from Vienna were *T. asynamorus*. To facilitate accurate identification a key is here given to the genera, *Diestrammena*, Br., *Tachycines*, Adel., *Dolichopoda*, Bol., and *Troglophilus*, Krauss. As regards injury, the view is expressed that these Orthoptera are not so harmless as formerly believed and that they feed on plants in the absence of animal food.

Kraus (R.). **Zur Frage der Bekämpfung der Heuschrecken mittels des** *Coccobacillus acridiorum*, **D'Herelle.** [The Control of Locusts by means of *Coccobacillus acridiorum*, d'Hérelle.]—*Centralbl. Bakt., Parasit. u. Infektionskr., Jena,* IIte. Abt., xlv, no. 18–25, 19th June 1916, pp. 594–599. [Received 20th May 1917.]

This article reviews the use of d'Hérelle's *Coccobacillus acridiorum* against locusts. The conclusion reached is that this bacillus is a normal intestinal host of the healthy locust and that only direct injection of this bacterium into the abdominal cavity will kill them.

Krausse (A.). **Zur Systematik und Naturgeschichte der Psylliden (Springläuse) und speziell von** *Psyllopsis fraxini*, **L.** [Systematic and bionomic Notes on the Psyllidae, especially *Psyllopsis fraxini*, L.]—*Centralbl. Bakt. Parasit. u. Infektionskr., Jena,* IIte Abt., xlvi, no. 1–5, 15th July 1916, pp. 80–96, 30 figs., 1 plate. [Received 20th May 1917.]

A full review of the work already done on *Psyllopsis fraxini*, L., is given, together with biological notes on this insect and a number of sketches illustrating its morphology. *Fraxinus excelsior*, L., is the principal of the various species of ash infested. The injury is usually unimportant, but when the trees are seriously infested, their growth

is much retarded. Various proprietary insecticides of German make are recommended against it, one being a nicotine-soap mixture. The larvae of *P. fraxini* are preyed upon by an unidentified Syrphid larva.

ZACHER (F.). **Die Literatur über die Blattflöhe und die von ihnen verursachten Gallen, nebst einem Verzeichnis der Nährpflanzen und Nachträgen zum "Psyllidarum Catalogus."** [The Literature on the PSYLLIDAE and the Galls formed by them, together with a List of Food-Plants and Supplements to the "Psyllidarum Catalogus."]—*Centralbl. Bakt., Parasit. u. Infektionskr., Jena,* IIte. Abt., xlvi, no. 6–10, 5th August 1916, pp. 97–111. [Received 20th May 1917.]

Only a bibliography of the PSYLLIDAE is given in the present part.

ALTHEIMER (K.). **Ueber im Jahre 1913 erschienene Mitteilungen über Schädlinge und Krankheiten der Obstbäume.** [On Communications made in 1913 regarding Enemies and Diseases of Fruit Trees.] —*Centralbl. Bakt., Parasit. u. Infektionskr,, Jena,* IIte. Abt., xlvi, no. 6–10, 5th August 1917, pp. 112–139. [Received 20th May 1917.]

The first section of this paper is a review of communications made in 1913 regarding the insect pests of fruit trees, dealing chiefly with the European ones.

ALTHEIMER (K.). **Obstbaumkrankheiten und Obstbaumschädlinge. Zusammenstellung wichtigerer, im Jahre 1914 erschienener Arbeiten.** [Fruit-Tree Diseases and Enemies: A Compilation of the more important Papers published in 1914.]—*Centralbl. Bakt., Parasit. u. Infektionskr., Jena,* IIte Abt., xlvi, no. 11–16, 2nd September 1916, pp. 347–364. [Received 20th May 1917.]

The title indicates the scope of this paper, of which the first part deals with insect pests in Europe and elsewhere.

BURKHARDT (F.). **Eine neue Chalcidide der Gattung** ***Dibrachys.*** [A new Chalcid of the Genus *Dibrachys.*]—*Centralbl. Bakt., Parasit. u. Infektionskr., Jena,* IIte. Abt., xlvi, no. 22–23, 1st November 1916, pp. 502–504, 1 fig. [Received 20th May 1917.]

In glasses in which *Calandra granaria*, L., was being bred, adults of a new Chalcid belonging to the genus *Dibrachys* emerged. This species is described, but no name is given to it. It is considered to be distinct from that which Zacher bred from *Calandra* and placed in the genus *Meraporus.*

STIFT (A.). **Ueber im Jahre 1915 veröffentlichte bemerkenswerte Arbeiten und Mitteilungen auf dem Gebiete der tierschen und pflanzlichen Feinden der Zuckerrübe.** [Noteworthy Papers and Communications published in 1915 on Animal and Plant Enemies of Sugar Beet.]—*Centralbl. Bakt., Parasit. u. Infektionskr., Jena,* IIte. Abt., xlvi, no. 22–23, 1st November 1916, pp. 515–540. [Received 20th May 1917.]

The title of this paper indicates the nature of its contents. The insect pests are dealt with in the first section.

Kieffer (—), **Beitrag zur Kenntnis der Platygasterinae und ihrer Lebensweise.** [A Contribution to the Knowledge of the Platygasterinae and their Life-history.]—*Centralbl. Bakt., Parasit. u. Infektionskr., Jena,* IIte. Abt., xlvi, 24–25, 18th November 1917, pp. 547–592. [Received 20th May 1917.]

This paper is almost entirely systematic. Keys are given to the various genera and species. These, with their Cecidomyid hosts, include: *Synopeas raphanistri,* sp. n., *Prosactogaster floricola,* sp. n., and *Platygaster cruciferarum,* sp. n., parasitising *Perrisia* (*Dasyneura*) *raphanistri* in *Rhaphanus raphanistrum*; *Misocyclops betulae,* sp. n., and *Platygaster betularia,* sp. n., parasitising *Semudobia betulae* in *Betula alba* and *B. pubescens*; *Inostemma avenae,* sp. n., parasitising *Contarinia avenae,* Kieff., in *Avena pubescens,* and *C. arrhenateri* in *Arrhenaterum elatius*; *Sactogaster pisi,* Först., parasitising *Contarinia pisi,* Winn., in *Pisum sativum*; *Leptacis lignicola,* sp. n., parasitising *Winnertzia pinicola,* Kieff., in *Pinus sylvestris*; *Misocyclops pini,* sp. n., parasitising *Thecodiplosis brachyntera,* Schwäg., in *Pinus sylvestris*; *Prosactogaster graminis,* sp. n., parasitising *Lasioptera graminicola,* Kieff., in *Calamagrostis lanceolata*; *Misocyclops ruborum,* sp. n., parasitising *Lasioptera rubi,* Heeg., in *Rubus* spp.; *Misocyclops leucanthemi,* sp. n., parasitising *Clinorrhyncha leucanthemi,* Kieff., in *Chrysanthemum leucanthemum.*

Dodd (A. P.). **Australian Hymenoptera: Proctotrypoidea. No. 4.**—*Trans. Proc. R. Soc. S. Australia, Adelaide,* xl, 23rd December 1916, pp. 9–32. [Received 21st May 1917.]

The new species described include:—*Dolichotrypes idarniformis,* sp. n., from one female found on the foliage of sugar-cane; *Polygnotus australis,* sp. n., from specimens bred from galls on the buds of *Careya australis*; *Sactogaster saccharalis,* sp. n., frequently found on the leaves of sugar-cane.

Lea (A. M.). **Notes on the Lord Howe Island Phasma, and on an associated Longicorn Beetle.**—*Trans. Proc. R. Soc. S. Australia, Adelaide,* xl, 23rd December 1916, pp. 145–147, 7 plates. [Received 21st May 1917.]

The Phasmid, *Karabidion* (*Eurycantha*) *australe,* Moutr., is a large wingless species which lives concealed by day in holes in living tree-stems. It selects for its domicile trees which have been already bored by the larvae of the large Longicorn beetle, *Agrianome spinicollis,* Macl., which by their interlacing borings have been found practically to destroy large orange and *Kentia* trees.

Banks (N.). **Acarians from Australian and Tasmanian Ants and Ant-nests.** — *Trans. Proc. R. Soc. S. Australia, Adelaide,* xl, 23rd December 1916, pp. 224–240, 8 plates. [Received 21st May 1917.]

This paper describes 36 new species of myrmecophilous mites from Australia and Tasmania. Only a few are attached to the ants, the others being largely scavengers. The ant, *Ectatomma metallicum,* is

the host of seven species of mites, while *Ponera lutea* and *Polyrachis hexacantha* are each associated with six species; one mite has been found with four species of ants, but as a rule they have only one host.

TURNER (A. J.). **New Australian Lepidoptera of the Family Tortricidae.** —*Trans. Proc. R. Soc. S. Australia, Adelaide*, xl, 23rd December 1916, pp. 498–536. [Received 21st May 1917.]

Among the 81 new species described in this paper is *Bondia nigella* bred from larvae found in plum-root galls.

LOWER (O. B.). **Descriptions of New Australian Micro-Lepidoptera.**—*Trans. Proc. R. Soc. S. Australia, Adelaide*, xl, 23rd December 1916, pp. 537–514. [Received 21st May 1917.]

Among the fourteen new species here described is *Tortrix eveleena*, sp. n., which appears to be gregarious and has very active larvae which feed on the leaves of the ornamental shrub, *Pittosporum phillyraeoides*.

MASI (L.). **Chalcididae of the Seychelles Islands.**—*Novitates Zoologicae, Tring*, xxiv, no. 1, 16th May 1917, pp. 121–130, 75 figs.

This systematic paper deals with the collection of CHALCIDIDAE made by the Percy Sladen Trust Expedition to the Western Indian Ocean in 1908–9. A strikingly large proportion of the species was found among the non-endemic vegetation at lower levels, especially in the narrow cultivated plains and small marshes which fringe the coast of the islands. The collection contains 69 genera and 93 species, of which 22 genera and 77 species are new to science.

The species previously known from other countries include, *Hockeria testaceitarsis*, Cam., discovered in the Caragados Is., *Coccophagus eleaphilus*, Silv., from Eritrea, *Melittobia hawaiiensis*, Perk., *Tetrastichus hagenowii*, Ratz., *Euplectrus bicolor*, Swed., and *Eucomys infelix*, Embl. Only 2 species were formerly known from the Seychelles, viz. :—*Chalcis sodalis* and *T. hagenowii*, Ratz., a very widely distributed parasite of the eggs of cockroaches.

BAGNALL (R. S.). **On a Collection of Thysanoptera from St. Vincent with descriptions of four new species.**—*Jl. Zool. Research, London*, ii, no. 1, March 1917, pp. 21–27, 3 figs.

The new species of West Indian thrips described in this paper are :—*Hoplandrothrips xanthopoides, H. brunneicornis, Malacothrips modestus* and *Cryptothrips collaris.*

HEADLEE (T. J.). **The Strawberry Weevil (*Anthonomus signatus*, Say).** —*New Jersey Agric. Exp. Sta., New Brunswick*, Circ. 56, 8 pp., 1 fig. [Received 22nd May 1917.]

The matter in this paper has already been abstracted [see this *Review*, Ser. A., iv, p. 189].

HEADLEE (T. J.). **Report of the Entomologist.**—*Rept. New Jersey Agric. Coll. Expt. Sta., 1915, New Brunswick,* 1916, pp. 306–335. [Received 22nd May 1917.]

In New Jersey the season of 1915 started with a tremendous outbreak of the American tent caterpillar (*Malacosoma americana*, Harr.) which occurred on wild cherry over wide areas and thence migrated to gardens and orchards. Control depends on organised action in cutting out and burning the webs and caterpillars or by spraying or dusting with lead arsenate. Owing to the cold season, apple Aphids became established before their parasitic enemies, the chief species being the rosy apple aphis (*Aphis sorbi*, Kalt.), which, contrary to previous experience, proved very difficult to kill. The best spray was found to be a combination of winter strength lime-sulphur and 40 per cent. nicotine at the rate of $\frac{3}{4}$ pint nicotine to 100 U.S. gals. of lime-sulphur, as this destroys both scale-insects and Aphids; the best time for treatment is just when the buds are beginning to show green, and not as previously thought between the opening of the buds and the opening of the blossoms. The safest method to adopt for the control of the green apple aphis, *Aphis pomi*, De G. (*mali*, F.) is the thorough spraying of all parts of the trees when they are beginning to shew green with winter strength lime-sulphur to which 40 per cent. nicotine has been added at the rate of 1 part nicotine to 1,000 parts lime-sulphur. If the Aphids appear between the opening of the buds and of the blossom, the orchard should be treated with a mixture of 40 per cent. nicotine, water and soap, the nicotine being at the rate of 1 part to 500 parts water, with soap added at the rate of 2 lb. to 50 U.S. gals. In the case of the melon aphis (*Aphis gossypii*, Glov.) and those species which are protected by the foliage, the best results followed the use of a stronger nicotine solution than those usually recommended. The cherry aphis (*Myzus cerasi*, F.) occurred everywhere and was not combated owing to the small value of the crop. Aphids on shade and forest trees and on bush fruit were less abundant than in the previous year, but those on market-garden crops were more numerous than usual. Potato Aphids were abundant, but did little damage and were not controlled. Tomatoes were badly infested with *Aphis rumicis*, L., and were satisfactorily sprayed with a mixture of 40 per cent. nicotine (1 part), water (500 parts), and soap at the rate of 2 lb. to 50 U.S. gals. *A. houghtonensis*, Trp., was reported as causing malformations of gooseberries.

The pear psylla (*Psylla pyricola*, Forst.) was very troublesome and no single method of control was successful, though the following combined operations were eminently so. (1) The rough bark should be scraped in autumn and winter and the scrapings burned in order to destroy adults hibernating in the crevices. (2) In winter and early spring the whole tree should be thoroughly sprayed to destroy crawling insects with winter-strength soluble oil or with 40 per cent. nicotine, soap and water (1 pint nicotine to 800 parts water with 1 oz. soap to the U.S. gal.). (3) The eggs should be destroyed by a thorough spraying with winter-strength lime-sulphur.

White grubs of the species *Lachnosterna fusca*, Froehl., *L. arcuata*, Smith, *Cyclocephala immaculata*, Oliv., and *Polyphylla variolosa*, Hentz.,

caused extensive damage to lawns, golf-courses and strawberry fields. Methods of controlling them as field and crop pests are well established, but experiments are being made on soil disinfection to prevent their damaging lawns and golf-courses. These experiments consisted in making holes 3 in. deep and 12 in. apart and pouring carbon bisulphide into them, the hole being closed by pressure with the heel. The best results were obtained with about $\frac{3}{4}$ oz. carbon bisulphide to the square foot and no injury to the grass was noticed. The rose-bug (*Macrodactylus subspinosus*, F.) was most destructive, the larva injuring lawns and the adult destroying rose-bushes, apple trees, grape-vines, bush fruits and maize. After many experiments with different insecticides, it was found that perfect protection was obtained by spraying with self-boiled lime-sulphur to which lead arsenate had been added at the rate of 2 lb. to 50 U.S. gals. The potato flea-beetle (*Epitrix cucumeris*, Harr.) was more abundant than ever, attacking both potatoes and tomatoes. Spraying with a mixture of 1 lb. pyrethrum, 10 oz. whale-oil soap and 10 U.S. gals. water was effective, and did not injure the plants, but its cost was prohibitive. Spraying with soap and water alone damaged the plants and killed very few beetles. The best protection was afforded by home-mixed 5-5-50 Bordeaux.

The army-worm, *Cirphis* (*Leucania*) *unipuncta*, Harr., was practically absent, following a year of great abundance. The Angoumois grain moth (*Sitotroga cerealella*, Oliv.) appeared in numbers for the first time for several years, damaging maize and wheat stored in heated buildings. To prevent this, the maize should be stored in a new crib, or the old one and its surroundings should be thoroughly freed from dust and grain accumulations and fumigated with carbon bisulphide about 30 days before the new crop is to be stored. The European pine-shoot moth, *Rhyacionia* (*Evetria*) *buoliana*, Schiff., appeared in large numbers on nursery stock imported from Holland. It is best controlled by pruning off infested buds in spring and burning them. The presence of the European mole-cricket (*Gryllotalpa gryllotalpa*, L.) was also reported. The ant, *Tetramorium cespitum*, L., caused extensive damage to lawns and even penetrated into houses, infesting sweet substances. A bait of syrup and tartar emetic successfully repelled invasions in houses. The onion thrips (*Thrips tabaci*, Lind.) seriously interfered with onion culture. The cabbage maggot, *Chortophila* (*Phorbia*) *brassicae*, Bch., appeared in very large numbers and did much damage, probably owing to relaxed measures of control in previous years. The garden webworm, *Phlyctaenodes* (*Loxostege*) *similalis*, Gn., appeared on lucerne and was most destructive over a large area. It was however readily destroyed by spraying with a solution of lead arsenate (3 lb. in 50 U.S. gals. water) using about 100 U.S. gals. to the acre. The sawfly, *Priophorus acericaulis*, MacGill, a leaf-miner of maples, was reported from two new localities and appeared to be on the increase. The application of kerosene emulsion to the soil as the larvae were entering it during the summer proved useless. The wheat-head army-worm, *Meliana* (*Leucania*) *albilinea*, Hb., damaged fields of timothy grass, but was comparatively scarce. *Corthylus punctatissimus*, Zimm., the pitted ambrosia beetle, was reported on rhododendrons, *Kalmia latifolia* and *Azalea mollis*. It also attacks

sugar-maple, sassafras, hazel, huckleberry and shade trees, and the only known remedy is the careful cutting and burning of the infested stems. The red spider, *Tetranychus telarius*, L. (*bimaculatus*, Harv.), the tulip soft scale, *Eulecanium tulipiferae*, Cook, the maple false scale, *Phenacoccus acericola*, King, the cottony maple scale, *Pulvinaria innumerabilis*, Rathv., *Macronoctua onusta*, Grt., and the apple maggot, *Rhagoletis pomonella*, Walsh, were unusually scarce, but *Lepidosaphes ulmi*, L., (oyster-shell scale), *Leptobyrsa explanata*, Heid., (rhododendron lace-bug), *Gastroidea cyanea*, Mels., the Agaristid, *Alypia octomaculata*, F., *Hemileuca maia*, Dru., and *Ceratomia catalpa*, Bdv., were plentiful. Serious damage was caused to pine trees by *Toumeyella pini*, King, a scale-insect new to New Jersey, and to blackberries by the Psyllid, *Trioza tripunctata*, Fitch. *Galerucella luteola*, Mull. (elm leaf-beetle), *Melasoma scripta*, F., on poplar, *Saperda candida*, F., (round-headed apple-tree borer) and *Anisota senatoria*, S. & A., on oak, were reported. *Crambus vulvivagellus*, Clem. (corn-root web-worm) infested maize on land which had been under pasture for several years previously.

The report concludes with detailed accounts, including numerous tables, of investigations on (1) The destruction of the mushroom spring-tail (*Achorentes armatum*, Nic.), which shewed that carbon bisulphide, although the best insecticide, cannot be used, as it seriously injures the mushrooms. (2) The control of the strawberry weevil (*Anthonomus signatus*, Say), the best method being a mixture of powdered lead arsenate and sulphur in equal parts. This weevil was found to hibernate among the moss, *Dicranum scoparium*. (3) Coatings against the peach borer, none however giving satisfactory protection. (4) The effect of moisture upon high lethal temperatures. (5) Potato dusting and spraying.

Mally (C. W.). **On the Selection and Breeding of desirable Strains of Beneficial Insects.**—*S. African Jl. Sci., Cape Town*, xiii, no. 5, December 1916, pp. 191–195. [Received 24th May 1917.]

It is claimed that in South Africa the fluted or cottony cushion scale or Australian bug, *Icerya purchasi*, has been successfully controlled by the introduction of the Coccinellid, *Novius cardinalis*, which is a rapid maturing species, although a slower indigenous species, *Aulis foetida*, had previously done good work in checking it. These two species differ in their relation to climate, *N. cardinalis* being able to stand heat better than *A. foetida*, with the result that it has exterminated the indigenous species in the southern part of the Cape Peninsula. On the other hand *A. foetida*, which is better able to bear cold, is found further north where *N. cardinalis* has failed to establish itself.

In 1900 another Australian Coccinellid, *Cryptolaemus montrouzieri*, was introduced into South Africa in the hope that it would establish itself and control the vine mealy-bug, *Pseudococcus capensis*. It was however found to be too large to enter the cracks in which the mealy bugs hide, while a smaller indigenous species was severely handicapped by the attacks of a parasite. The solution seems to lie in finding a strain of this species which is distasteful to its parasite. In 1915 the question was under discussion of introducing *N. cardinalis* into Mauritius against *Icerya seychellarum*, which was only just kept within

bounds by *N.* (*Vedalia*) *chermesina*, which increases slowly and is not operative all the year round. The practical solution in such cases appears to be the introduction of quickly-maturing strains, thus increasing the number of broods per annum, and their reinforcement till they become dominant.

In certain hosts such as black scale, *Saissetia oleae*, and Hessian fly, *Mayetiola destructor*, the problem is complicated by the presence of several species of parasites, which are supplementary up to a certain point and then become competitive, so that in the event of a pest being introduced into new surroundings, only that parasite which most effectively controlled it in its original locality should also be transferred to its new home.

Annual Report of the Horticulture Branch for the Year 1916.—*Jl. Bd. Agric., London,* xxiv, no. 2, May 1917, pp. 142–158.

Apple and pear growers in the south and midlands of England sustained serious losses from severe infestations of the larvae of the winter moth [*Cheimatobia brumata*], various species of *Tortrix*, and other insect pests. Several investigations of a scientific and practical nature have been carried out during the past 12 months. The long and detailed enquiry into the parasitism of the large larch sawfly [*Lygaeonematus erichsoni*] has been concluded, though the results have not yet been tabulated; they are largely of a negative character. This sawfly has at present almost disappeared from the infested area and the economic injury to larch plantations is not noticeable. No cases of scheduled pests such as *Phylloxera*, Colorado potato beetle [*Leptinotarsa decemlineata*] or *Aulacaspis* (*Diapi s*) *pentagona* were reported during the year.

Isle of Wight bee disease now seems to have spread over the whole of England; the study of the disease has been continued and many experiments conducted. Two drugs have been found fairly successful in cases that have not developed beyond a certain point. In order to secure definite data on this point experiments were undertaken throughout a whole village under the conditions that every colony in the district was to be examined for signs of *Nosema apis*; all colonies pronounced beyond hope of successful treatment were to be destroyed; no other treatment was to be applied during the experiment; the bees to be under the supervision of a local expert and to be finally examined before conclusion of the experiment. The results are not yet conclusive, but are apparently fairly satisfactory, since in the treated colonies several swarms have been thrown off and a large supply of honey obtained, while all the bees died in untreated villages in the vicinity. Several specifics have been offered to the public for which remarkable properties are claimed, but it is considered that a claim to a satisfactory cure can be substantiated only on the condition that microscopical examinations of specimens from a suspected colony have revealed the presence of *Nosema apis* in large numbers in the bees' intestines and that the treatment must be applied under conditions which eliminate all possibility of other influences being present. The effect of treatment can only be judged by microscopical examination to determine the presence or absence of *Nosema apis*. Moreover, no treatment can be considered effective unless the

bees remain healthy and free from *Nosema* for a considerable time and survive the following winter, as there is no difficulty in stimulating affected bees in such a way that they temporarily throw off all the symptoms usually associated with this disease.

JACK (R. W.). **The Turnip Sawfly (*Athalia flacca*, Konow.)**—*Rhodesia Agric. Jl., Salisbury*, xiv, no. 2, April 1917, pp. 206–212, 2 plates.

Athalia flacca, Kon., formerly erroneously recorded as *A. rosae*, L. [see this *Review*, Ser. A, ii, p. 236], attacks all cultivated Cruciferae throughout Rhodesia, its native food-plants being unknown; in severe infestations the crop may be entirely stripped of its leaves. The eggs are laid in slits made in the edges of the leaves, where the newly hatched larvae begin to feed. After about 17 days, the larva descends about one inch into the soil where it constructs a tough cocoon, the pupal stage lasting at least 10 days. There are apparently at least four complete broods during the year; these overlap, the greatest injury being done by the larvae present in January and February. Contrary to the habits of moths with a similar life-history, such as *Laphygma exigua*, Hb. (pigweed caterpillar), *Hellula undalis*, F. (cabbage webworm) and *Plutella maculipennis*, Curt., the adult sawflies that emerge during the dry season have never been recorded as injuring crops grown under irrigation; in fact dry weather is apparently inimical to the increase of this sawfly. As the insect becomes less abundant towards the close of the rainy season in spite of continued abundance of food, it is probably checked to some extent by natural enemies, though only one parasite, a Tachinid fly, has as yet been bred from specimens collected in the field. Experiments with arsenate of lead sprays against the mature larvae, which have been tried for several years, have led to the conclusion that in order to kill the grubs arsenicals must be used in such strength that they would injure the plants. Adult sawflies can be controlled by a weekly spray of 1 lb. lead arsenate to 16 gals. water; the best control for the larvae on young crops is a spray of paraffin emulsion, made of 1 lb. soap dissolved in 2 gals. water to which 4 gals. paraffin oil are added to make a concentrated emulsion; this should be used in the proportion of one part to nine parts water. The spray must be applied with force and causes many grubs to fall from the plants, so that the ground beneath must also be well sprayed.

PEAD (C. H.). **Cicadas and their Relatives.**—*Rhodesia Agric. Jl., Salisbury*, xiv, no. 2, April 1917, pp. 240–247, 3 plates.

This paper describes the chief characteristics of the CICADIDAE and the allied families with notes on their life-histories. These Homoptera probably destroy about one-sixth of the total crops in Rhodesia and the only remedy that can be suggested against their depredations is cultivation, as they are less abundant on well cultivated ground.

MOZNETTE (G. F.). **Three Insects affecting Clover Seed Production.**—*Oregon Agric. Coll. Extn., Corvallis*, Bull. no. 203, April 1917, 4 pp., 5 figs.

The injury to clover in Oregon by *Perrisia leguminicola* (clover-seed midge) and *Bruchophagus funebris* (clover-seed Chalcid) has already

been described [see this *Review*, Ser. A, iii, p. 266]. Changing the time of blooming of the clover seed crop is recommended. If both a hay and seed crop are desired, the hay should be mowed 10 days to two weeks earlier than usual, in order to prevent development of the maggots by drying up their food-plant. This practice hastens the development of the second crop of clover heads, so that the second generation of midges have but few green heads in which to lay their eggs. A common practice is to pasture sheep on clover during April and then remove the sheep and obtain a seed crop. In this case the clover should be clipped after removal of the sheep and any clover heads destroyed.

Hylastinus obscurus (clover root-borer) is the most serious pest of red clover in the Pacific Northwest. The beetle passes the winter in the adult stage in the tunnels in the clover roots made by the larvae of the previous season. In spring the adults leave the tunnels and fly over fields of young clover, the females depositing eggs in the sides of the root and the crown of the plant; these give rise to the adults of the next generation about 1st August. Alsike, lucerne, vetch, field beans and peas may all serve as breeding-places for the beetles. Cultural methods are the only control as yet known. Immediately after the harvest of the first year crop, the field should be ploughed, in order to turn up infested roots and starve the grubs inside. This should be done early in July before the larvae pass into the pupal stage. All self-sown clover should be destroyed.

RUGGLES (A. G.). **Spraying Number.**—*Minnesota Insect Life, St. Paul, Minn.*, iv, no. 1, April 1917, 8 pp., 2 plates, 12 figs.

This number contains a spraying calendar with descriptions and illustrations of several types of spraying apparatus.

HENRY (G. M.). **The Coconut Red Weevil,** *Rhynchophorus ferrugineus.* —*Trop. Agric., Peradeniya*, xlviii, no. 4, April 1917, pp. 218–219.

This insect is commonly found damaging coconuts in Ceylon. *Caryota urens* and *Areca catechu* are other species of palms which probably constitute secondary hosts of the weevil. Eggs are laid in cuts or wounds in the stem, frequently in holes made by the rhinoceros beetle [*Oryctes rhinoceros*], the damage being done by the larvae; these, immediately upon hatching, burrow into the wood, converting the inside of the stem into a soft pulp in which the grubs live and tunnel in every direction. The fermenting mass inside the stem attracts other weevils and ultimately the plant is destroyed, though the presence of the beetles may be quite invisible from the outside. The length of the larval period is apparently unknown, but is probably long. When mature, the larva forms a cocoon of broken fibres of the stem inside the galleries. No parasitic or predatory enemies of *R. ferrugineus* have as yet been found in Ceylon. The usual method of dealing with the pest is to clear out all the grubs and damaged tissue of the tree and fill the hole with tarred fibre. Injections of carbon bisulphide through an augur hole bored in a slanting direction have been tried, the hole afterwards being stopped up with tarred fibre. This plan has not yet been sufficiently tested, but owing to the difficulty of obtaining carbon bisulphide in Ceylon it is not likely to be generally adopted. Trapping

the adult weevils with baits of fermenting kitul palm wood might be an effective means of control. Cultivation is an important factor; all dead palms should be cut down and burnt and no rotting stems should be allowed to lie about on the ground. *O. rhinoceros* should be eliminated as far as possible by means of traps and probing, and the bark of the palms should be protected from injury.

Bastin (H.). **British Insects and How to Know them.**—*London*: Methuen & Co., Ltd., June 1917, 129 pp., 12 plates, 8vo. Price 1*s*. 6*d*.

The object of this small text-book is to provide a popular introduction to the study of British insects. Following a definition and description of insects in general and a brief review of their evolution and development from elementary forms, an outline classification, adopted from Prof. G. H. Carpenter, of the various orders is given, the distinctive characteristics of each being described, with notes on the life-histories and habits of some of the British species. Both the popular and scientific names of the species dealt with are given and 12 good plates from photographs illustrate the text. A sufficient index is appended.

Parrott (P. J.) & Glasgow (H.). **The Leaf-Weevil** (*Polydrusus impressifrons*, **Gyll.**)—*New York Agric. Expt. Sta., Geneva*, Tech. Bull. no. 56, December 1916, 24 pp., 6 figs., 8 plates. [Received 30th May 1917.]

An account of this paper has already appeared [see this *Review*, Ser. A, iv, p. 519], but an appendix by Mr. A. B. Gahan gives a description of *Diospilus polydrusi*, sp. n., a Braconid parasite of this weevil. It apparently lays an egg in that of *P. impressifrons* early in June so that the larva is already in the body of the host when it hatches, and here it remains till May of the following year. After destroying the host, a cocoon is formed within the earthen cell constructed by the host larva, and here the parasite completes its development, the adult emerging early in June. The species is very numerous and active during some seasons and should exert an important repressive action.

Parrott (P. J.). **Some Insects attacking the Pear, and their Control.**—*New York Agric. Expt. Sta., Geneva*, Circ. 51, 15th May 1916, 18 pp. [Received 30th May 1917.]

Articles by this author on some of the above insects have already been noticed, namely, the sinuate borer (*Agrilus sinuatus*, Oliv.) [see this *Review*, Ser. A, iv, p. 273], the codling moth (*Cydia pomonella*, L.) [see this *Review*, Ser. A, iii, p. 445], the false tarnished plant bug (*Lygus invitus*, Say) [see this *Review*, Ser. A, i, pp. 126–127] and the pear psylla (*Psylla pyricola*, Förster) [see this *Review*, Ser. A, i, p. 127].

Others now dealt with are *Saperda candida*, F. (round-headed borer), *Chrysobothris femorata*, F. (flat-headed borer), *Aspidiotus perniciosus*, Comst. (San José scale), *Lepidosaphes ulmi*, L. (oyster-shell scale), *Chionaspis furfura*, Fitch (scurfy scale), *Contarinia pyrivora*, Riley (pear midge), *Conotrachelus nenuphar*, Hbst. (plum curculio), *Eucosma* (*Tmetocera*) *ocellana*, Schiff. (bud moth), *Cacoecia* (*Archips*) *rosaceana*,

Harr. (oblique-banded leaf-roller), *C.* (*A.*) *argyrospila*, Walk. (fruit-tree leaf-roller), *Xylina* spp. (green fruit-worms), *Eriocampoides limacina*, L. (pear slug), and *Eriophyes pyri*, Pgst. (blister mite), the usual controls being mentioned in each case.

PARROTT (P. J.) & HODGKISS (H. E.). **Periodical Cicada in 1916.**—*New York Agric. Expt. Sta., Geneva,* Circ. no. 50, 15th May 1917. 4 pp., 2 plates.

The destructiveness of the periodical cicada [*Tibicen septemdecim*] is not due to the feeding of the larva, which takes place underground on the sap of the roots of trees, shrubs and vines and is almost negligible in amount owing to the extraordinary slowness of growth and development, extending over a period of 17 years. The adults likewise eat little or nothing, but important injury is caused to trees by the females puncturing the twigs and smaller limbs in order to oviposit, with the result that the limbs are so weakened as to break off with the slightest wind.

The best method of control is the spraying of the emerging nymphs with home-made or commercial oil emulsion, which is fatal to them. There seems to be no practical method of controlling the adults when occurring in large numbers over wide areas. Trees thoroughly sprayed with Bordeaux mixture or a lime wash are apt to be avoided, especially if there are other trees in the neighbourhood on which the insects can oviposit. Young stock should not be planted in those localities where the insects are known to occur during the two years previous to their expected appearance.

PARROTT (P. J.), HODGKISS (H. E.) & LATHROP (F. H.). **Plant Lice injurious to Apple Orchards. II. Studies on Control of newly hatched Aphides. II.**—*New York Agric. Expt. Sta., Geneva,* Bull. no. 431, March 1917, pp. 33–79, 1 fig., 1 plate, 18 tables. [Received 30th May 1917.

This paper deals with the continuation of experimental work on apple Aphids [see this *Review*, Ser. A, iv, pp. 273–275], with the special object of discovering the effect of the so-called "delayed dormant treatment" in the control of the rosy aphis (*Aphis sorbi*).

In 1916 the infestation of orchards in western New York was not severe, and the three species concerned, *Aphis sorbi*, *A. avenae* (oat aphis) and *A. pomi* (green aphis) exhibited the usual seasonal cycle, which is fundamentally constant, but varies slightly from year to year. On 22nd April many oat aphis had hatched, but only a few rosy aphis. By 26th April the rosy aphis had reached their maximum number, being chiefly responsible for the dwarfing of apples, and on the same date the green aphis began to emerge. The egg-distribution of the three species showed marked differences, those of *Aphis pomi* being in heavy local infestations, while those of *A. sorbi* and *A. avenae* were uniformly scattered throughout the orchards, being nowhere very dense. The second generation of *A. avenae* consisted of winged insects, so that this species had entirely disappeared by the end of June, having done little damage, causing at most only a slight curling of the foliage. From the middle of June until the end of the month *A. sorbi* was the most abundant, its attack resulting in a severe and characteristic

curling of the leaves. In July its migration began, and by the end of this month apples were abandoned by it. The second generation of *A. pomi* was winged and therefore spread throughout the orchards, remaining the dominant species till the end of the season; its effect on the foliage being intermediate between that of the other two species.

To test the effects of the three species on the fruits, normal fruit clusters were artificially infested and enclosed in fine silk netting. The results showed that the injury caused by *Aphis avenae* was only slight, resulting in a slightly one-sided growth, and in the increased number of apples in a cluster, the so-called aphis apples. The most severe injury was done to clusters attacked early by *A. sorbi* and *A. pomi*, the fruit being completely destroyed. By the end of May and early in June clusters infested by *A. sorbi* had badly distorted fruits and by the end of June the distortion was extreme. Clusters infested with *A. pomi* showed a similar distortion, but instead of the formation of aphis apples, all save one or two in the clusters were destroyed.

From a consideration of these data, it was evident that control measures to be effective must be undertaken at the end of April or very early in May. Consequently on 1st May, when the leaves of the more advanced buds were projecting from $\frac{1}{4}$ to $\frac{1}{2}$ inch, 52 trees were sprayed with 40 per cent. nicotine solution, $\frac{3}{4}$ pint being added to 100 U.S. gals. of lime-sulphur solution diluted 1 part to 8 parts of water; the efficacy of this treatment depends on the thorough wetting of every bud, 11 gals. being required for each tree. Although it may be objected that owing to its lateness this application may injure the foliage and afford only a poor protection against the blister mite, this is more than counterbalanced by its deadly effect on the newly-hatched nymphs of *Aphis sorbi*, the eggs of which are unaffected by lime-sulphur, and the protection afforded by it against early apple-scab infections. In the above experiment, not one of the 52 trees showed a single injured fruit or curled leaf, while of untreated control trees, one had 106 injured fruits, and another 486 curled leaves.

Parrott (P. J.). **Insects that Factor in the Grading of Apples.**—*Address to Western New York Hortic. Soc., Geneva, N.Y.*, 24th January 1917, 10 pp. [Received 30th May 1917.]

The relative degree of infestation of the principal apple pests causing malformation in the fruit in New York during 1916 are shown in a figure. The codling moth [*Cydia pomonella*] is by far the most serious pest, infestations in lesser degree being shown in the following order by Aphids, red bugs [*Heterocordylus malinus*], curculio [*Anthonomus quadrigibbus*], lesser apple worm [*Enarmonia prunivora*], leaf-roller [*Cacoecia argyrospila*], green fruit worm [*Xylina*], San José scale [*Aspidiotus perniciosus*], bud moth [*Eucosma ocellana*], Palmer worm [*Dichomeris ligulella*] and apple maggot [*Rhagoletis pomonella*]. Another figure shows the sequence of attacks by these pests on the apple crop from the time of blossoming until harvest, and the exact form of damage by each species is described. A few species cause damage to apples after the crop is picked and barrelled. Codling moth larvae may be carried into store-houses in the fruit and under favourable

conditions may feed on the fruits and later emerge and spin cocoons. Apples that have been selected with care and then placed in storage at a temperature between 32° and 45° F., do not suffer from occasional infested fruits, as the larvae are not active at this temperature. Occasional damage by the lesser apple worm may occur under similar conditions to those just mentioned for codling moth; while San José scale, which might rapidly damage stored apples at a favourable temperature, is controlled at a temperature of from 30° to 32° F. Apples that may be infested with apple maggot should never be allowed to remain in the orchard or in a barn after picking, or they may deteriorate rapidly. They should be placed immediately in cold storage. The difficulties of grading apples on account of insect damage would be greatly simplified if more careful consideration were given to the practices of spraying, thinning, cultivation, etc.

Insect Pests in the West Indies in 1916.—*Agric. News, Barbados,* xvi no. 392, 5th May 1917, pp. 138–139.

The more important insects occurring during the year were:—*Lachnosterna* sp. (brown hard back) commonly found in Antigua, a Scoliid parasite of it, probably *Tiphia parallela*, occurring in a portion of the infested district. Controls suggested included rotation of crops, better drainage, the application of pen manure wherever available, the use of a trap-crop, such as maize, the collection of grubs and the encouragement of insect parasites. An outbreak of *Tomaspis saccharina*, Dist. (sugar-cane froghopper) in Grenada has already been recorded [see this *Review*, Ser. A, v, p. 268]. *Alabama argillacea*, Hb. (cotton worm) was a severe pest in some localities, and in St. Kitts was materially controlled by *Polistes crinitus* (Jack Spaniard). *Dysdercus delauneyi*, Leth. (cotton stainer) was abundant in St. Vincent, where the wild food-plants, *Eriodendron anfractuosum* and *Thespesia populnea*, were energetically destroyed. In other islands, hand-picking the stainers during the early part of the year apparently checked infestation. *Eriophyes gossypii*, Bks., occurred generally in the cotton-growing districts, but is no longer a serious pest. On cacao, *Heliothrips rubrocinctus*, Giard (cacao thrips) was generally distributed and was locally severe in Grenada and St. Vincent.

Limes and other citrus trees suffered from the usual scale-insects, and *Orthezia insignis*, Dougl. (lantana bug) occurred in the spring in Montserrat. *Leptostylus praemorsus*, F. (bark borer), was generally distributed in St. Lucia, with locally severe infestations. Weevils of the genus *Diaprepres* fed on the leaves of young citrus trees, while the larvae damaged the roots. *Scapteriscus didactylus*, Latr. (mole-cricket) caused serious losses to lime seedlings in St. Lucia.

Maize was attacked by caterpillars, mainly *Heliothis obsoleta* (*armigera*), which in some localities became a serious pest. Damage was also caused by *Laphygma frugiperda*, S. & A., *Diatraea saccharalis*, F., *Lachnosterna* sp., and mole-crickets.

Coconut pests included *Aleurodicus cocois*, Curt., and *Aspidiotus destructor*, Sign., of which severe attacks occurred in several localities. Sweet potatoes were attacked by *Euscepes batatae*, Waterh., and the larvae of the small moth, *Sylepta helcitalis*, was troublesome in Montserrat. Beans were attacked by *Anticarsia* (*Thermesia*) *gemmatalis*, Hb., and onions by *Thrips tabaci*, Lind.

The Cerambycid borer, *Batocera rubus*, is spreading rapidly in the Virgin Islands. It attacks *Ficus* sp., *Carica papaya* (papaw), *Spondias lutea* (hog plum) and other trees.

HEWITT (C. G.). **Report of the Dominion Entomologist for the Year ending March 31, 1916.**—*Dominion of Canada, Dept. Agric. Ottawa*, 1917, 70 pp., 9 figs. [Received 31st May 1917.]

Owing to the disturbed conditions in Europe the number of plants imported during the season 1914–15 was only about half that of the previous year, but the inspection service was much improved owing to a regulation requiring inspection at the port of entry instead of at the point of destination.

The intensity of the infestation of the brown-tail moth [*Euproctis chrysorrhoea*] was reduced in Nova Scotia and New Brunswick by careful scouting work, in spite of an increase in the area infested, as well as by the unfavourable conditions at the time of the flight of the moths from the New England States and the heavy mortality of the caterpillars in the preceding winter owing to climatic conditions.

The natural enemies of the gipsy [*Lymantria dispar*] and brown-tail moths were collected or reared and imported and liberated during the season, to the number of 72,000 parasites (*Compsilura concinnata*, *Apanteles lacteicolor*, and *Meteorus versicolor*) and 3,400 predaceous beetles (*Calosoma sycophanta*). The natural control of the three native insect pests, the forest tent caterpillar (*Malacosoma disstria*), the fall web-worm (*Hyphantria textor*), and the spruce bud-worm, *Tortrix* (*Harmologa*) *fumiferana*, was further studied with good results, though the investigation is expected to extend over another three years.

Insects affecting cereal and field crops included cutworms, which were unusually abundant especially in the prairie provinces, the most destructive species being the red-backed cutworm, *Euxoa ochrogaster*, Gn., which destroyed considerable areas of wheat and oats. *E. tessellata*, Harr., the striped cutworm, and *E. messoria*, Harr., the dark-sided cutworm, were also very abundant, young beets, carrots, onions and large areas of tobacco being destroyed. The glassy cutworm, *Hadena devastatrix*, Brace, seriously damaged crops of wheat, oats, barley, timothy grass and maize. An extensive and dangerous outbreak of the army cutworm, *Euxoa* (*Chorizagrotis*) *auxiliaris* occurred for the first time in Canada, but energetic control measures prevented wide-spread loss. Important data have been secured regarding the control of white grubs (*Lachnosterna* spp.). A study of the distribution and life-histories of the grass stem-maggot flies (OSCINIDAE) which affect grasses and cereals has been begun. The results of investigations on the cabbage maggot, *Chortophila* (*Phorbia*) *brassicae* Bch., the onion maggot, *Hylemyia antiqua*, Mg., (*Phorbia ceparum*), and the seed-corn maggot, *Chortophila* (*Phorbia*) *fusciceps*, Zett., are being published in the form of a bulletin. Locusts, especially the lesser migratory locust (*Melanoplus atlantis*, Riley), and the pellucid locust (*Camnula pellucida*, Scudd.) were very abundant and attacked oats, barley, timothy grass, buckwheat, clover, tobacco, potatoes, corn and celery, but organised co-operation in the use of poisoned bait gave markedly good results. The mixture, which killed 90–95 per cent. of the insects, was:—Bran, 20 lb.; Paris green, $1\frac{1}{2}$ lb.; lemons, 3;

molasses, 2 quarts; water, 2½ to 3 gals. Other insects reported were, the pea Bruchid (*Bruchus pisorum*, L.), the ash-grey blister-beetle (*Macrobasis unicolor*, Kirby), the carrot rust fly (*Psila rosae*, F.), the pea aphis, *Acyrthosiphon* (*Macrosiphum*) *pisi*, Kalt., the potato aphis (*M. solanifolii*, Ashm.), the grain aphis (*M. granarium*, Kirby), which however was attacked by parasites and predaceous insects so that little injury resulted, the red turnip beetle (*Entomoscelis adonidis*, F.), the 12-spotted asparagus beetle (*Crioceris 12-punctata*, L.), and the common asparagus beetle (*C. asparagi*, L.), as well as a new cabbage pest, *Tortrix wahlbomiana* var. Tr. *virgaureana* (*oleraceana*, Gibson).

The most destructive garden and greenhouse pests in 1915–16 were :—*Otiorrhynchus sulcatus*, F. (black vine-weevil) on cyclamens, *Phytomyza chrysanthemi*, Kowarz (marguerite leaf-miner), *Pionea* (*Phlyctaenia*) *rubigalis*, Gn. (greenhouse leaf-tier) on cinerarias, marguerites, chrysanthemums and snapdragons, *Diarthronomyia hypogaea*, Lw. (chrysanthemum midge), *Rhynchites bicolor*, F. (black-snouted rose weevil), *Poecilocapsus lineatus*, F. (four-lined leaf-bug) on asters and dahlias, and *Systena frontalis*, F. (red-headed flea-beetle) on asters and chrysanthemums.

The chief insects affecting fruit crops were :—In Quebec, *Anthonomus quadrigibbus* (apple curculio); in Ontario, *Aphis sorbi*, *A. pomi*, *A. avenae*, and the apple-maggot (*Rhagoletis pomonella*), control investigations on which were continued. Observations were also made on *Psylla pyricola* (pear psylla), *Myzus cerasi* (cherry aphis), and *Byturus unicolor* (raspberry beetle). In British Columbia there was a serious outbreak of the pear thrips, *Taeniothrips inconsequens* (*pyri*), and the occurrence of the currant bud-mite (*Eriophyes ribis*) was recorded.

Among the insects attacking forest and shade trees, *Chermes cooleyi*, Gill. (Sitka spruce gall aphis), and a new variety *C. cooleyi* var. *coweni*, Gill., were studied in British Columbia, as well as *Aphis abietina*, Walk. (Sitka spruce green aphis), and *Chermes funitectus*, Dreyf. (western hemlock woolly aphis), the latter being found to be heavily attacked by Syrphid and Coccinellid larvae. *Dendroctonus obesus*, Lec. (Sitka spruce bark beetle), was effectively controlled, though rapid breeding and consequent spread took place if the destruction of refuse from cuttings or windfalls was neglected. Observations were made on the Buprestid borer belonging to the genus *Trachekele*, an insect very destructive to green timber. In Alberta, studies were made of *Dendroctonus borealis*, Hopk., in white spruce, *D. simplex*, in larch, an undescribed species of *Dryocoetes* killing large balsams, and the very destructive wood-borer, *Monochamus* (*Monohammus*) sp. closely allied to *M. scutellatus*, resulting in the discovery of inexpensive and effective methods of control. In New Brunswick, *Tortrix* (*Harmologa*) *fumiferana* (spruce bud worm) was abundant, but controlled by natural factors. The larch sawfly, *Lygaeonematus* (*Nematus*) *erichsoni*, was reported to be spreading westwards to Saskatchewan. The negundo aphis (*Chaitophorus negundinis*) and the poplar leaf-beetle (*Galerucella decora*) were abundant and caused wide-spread injuries.

In Nova Scotia the life-histories of *Cacoecia* (*Archips*) *rosaceana*, Harr., and *Olethreutes consanguinana*, Wlsm., were worked out, and and further work was done on the eye-spotted bud moth *Eucosma* (*Spilonota*) *ocellana*, Schiff. The lesser bud moth (*Recurvaria nanella*, Hb.) was found in Nova Scotia for the first time. The fall cankerworm

(*Alsophila pometaria* Harr). was particularly injurious, and the widespread distribution of the eggs of *Hemerocampa leucostigma* (white-marked tussock moth) pointed to a serious outbreak.

In New Brunswick the Colorado potato beetle (*Leptinotarsa decemlineata*) and the oyster-shell scale (*Lepidosaphes ulmi*) were abundant; the Amatid moth, *Ctenucha virginica*, though present, was uncommon.

In Quebec the injurious insects of 1915 were *Cacoecia* (*Archips*) *argyrospila*, *Vanessa antiopa* (spring elm-tree caterpillar), *Eucosma ocellana*, *Lepidosaphes ulmi*, *Eriosoma* (*Schizoneura*) *lanigerum* (woolly aphis), and especially *Rhagoletis pomonella* (apple maggot or railroad worm).

The Ontario investigations on apple Aphids were carried out and the following list of natural enemies was drawn up:—COCCINELLIDAE—*Adalia bipunctata*, *Coccinella novemnotata*, *C. trifasciata*, *C. transversoguttata*; SYRPHIDAE—*Syrphus torvus*, *S. americanus*, *S. ribesii*, *Allograpta obliqua*, *Sphaerophoria cylindrica*; OCHTHIPHILIDAE—*Leucopis simplex*; PEMPHREDONIDAE—*Pemphredon inornatus*; CHRYSOPIDAE—*Chrysopa plorabunda*. Control experiments were carried out against the pear psylla, *Psylla pyricola*. Damage was reported by *Aegeria* (*Sesia*) *pictipes* (lesser peach borer), *Monophadnoides rubi* (raspberry sawfly), *Neocerata* (*Dasyneura*) *rhodophaga* (rose midge), *Rhopalosiphum ligustri*, *Aphis viburnicola*, *Chermes pinicorticis* on Scotch pines, *Coccus hesperidum*, *Saissetia hemisphaerica*, *Aspidiotus hederae*, and *Hemichionaspis aspidistrae* in greenhouses. *Crioceris asparagi* (asparagus beetle) was held in check by the Chalcid, *Tetrastichus asparagi*. *Datana integerrima*, the black walnut caterpillar was very abundant.

In Manitoba the fly, *Meromyza americana*, was reared from growing wheat, barley and grasses, *Agromyza coquilletti* from leaves of wheat and barley, *Oscinella* (*Oscinis*) *frit* from wheat, *O. coxendix* from wheat and maize, and *O. dorsata* from maize. Other pests were the cutworm, *Euxoa malis*, *Cephus occidentalis* (western wheat-stem sawfly), *Pieris* (*Pontia*) *rapae* (cabbage worm), *Melasoma* (*Lina*) *scripta* (cotton-wood leaf-beetle), *M.* (*L.*) *lapponica* (spotted willow leaf-beetle), *Pteronus ventralis*, and *Lophyrus abietis* (spruce sawfly).

In Alberta the parasites, *Meteorus vulgaris*, *Copidosoma* sp., and a species of *Ichneumon*, were bred from the larvae of the army cutworm, *Euxoa* (*Chorizagrotis*) *auxiliaris*. The predators, *Calosoma tepidum* and *Ammophila* sp. were numerous. The cutworm, *Porosagrotis orthogonia*, was seldom seen. The grasshoppers, *Chorthippus curtipennis* and *Melanoplus bruneri*, were serious pests, and *Myzus ribis* was particularly abundant on currants.

In British Columbia, the wheat midge, *Contarinia* (*Diplosis*) *tritici*, was investigated. The presence of the cutworm, *Peridroma saucia*, the cabbage aphis (*Aphis brassicae*), and the cabbage worm (*Pieris rapae*) was reported, while pests of increasing importance were the lesser apple worm (*Enarmonia prunivora*), the currant fruit-fly (*Epochra canadensis*), and the peach twig-borer (*Anarsia lineatella*). The San José scale (*Aspidiotus perniciosus*), the strawberry root-weevil (*Otiorrhynchus ovatus*), and the pear thrips (*Taeniothrips inconsequens*), were recorded from Victoria, and the currant bud-mite (*Eriophyes ribis*) from Vancouver. The codling moth (*Cydia pomonella*) was reported to be spreading owing to packing-cases and railroad freight-cars being infected.

Malenotti (E.). **Sopra un caso di endofagia dell' "*Aspidiotiphagus citrinus*" (Craw) How. sul "*Chrysomphalus dictyospermi*" (Morg.) Leon.** [A Case of Endophagy of *Aspidiotiphagus citrinus*, Craw, on *Chrysomphalus dictyospermi*, Morg.]—*Redia, Florence,* xii, no. 1–2, 25th April 1917, pp. 15–18.

This is a record of the parasitation by *Aspidiotiphagus citrinus* of *Chrysomphalus dictyospermi* on *Sanseviera arborescens* in the greenhouses of the Colonial Agricultural Institute at Florence. This parasite has not been noted on citrus plants growing in the open.

Cavazza (C.). **Seconda Serie di Esperienze interno all' Influenza di alcuni Agenti Chimici sul** *Bombyx mori*. [A second Series of Experiments on the Influence of some Chemicals on *Bombyx mori*.]—*Redia, Florence,* xii, no. 1–2, 25th April 1917, pp. 69–107.

This paper records the action of various chemicals on the development and reproductive powers of *Bombyx mori*.

Del Guercio (G.). **Contribuzione alla Conoscenza degli Aphidi.** [A Contribution to the Knowledge of Aphids.]—*Redia, Florence,* xii, no. 1–2, 25th April 1917, pp. 197–277, 3 plates.

This paper is chiefly systematic and contains keys to the genera and species of many European, African and American Aphids; many of these are of economic importance, whilst others are new, or have been insufficiently described. It is pointed out that the mere record of the presence on foreign plants of a noxious species may prevent its spread by putting importers on their guard.

Francoa elegans, gen. et sp. n., occurs on roses in Italy. A key is given, enabling this genus to be distinguished from *Rhopalosiphum*, Koch, and *Siphocoryne*, Pass. When noticed in June, it appeared to do more severe damage than *Macrosiphum rosae*, De G., or *Myzus rosarum*, Kalt. *Anuraphis persicae-niger*, Smith (black peach aphis), has been noticed in Italy on peaches of American origin, the injury being quite as severe as in Colorado. Imported plants infested with this Aphid should be immersed in tar oil, $3\frac{1}{2}$–5 gals.; commercial soda ($Na\ CO\ $), 20 lb.; and water, 45 gals. The soda is dissolved in 5 gals. of boiling water and this solution is poured into a cask containing the tar oil and well mixed, after which the remaining 40 gals. of water is added and the whole is stirred again. The plants should be completely immersed and moved about in the liquid for 10 minutes, and this will destroy the eggs of any Aphid living on cultivated plants. If peaches have already been planted, a nicotine-soap spray is required. To prepare this a handful of fine ash is put in 5 gals. of water and $7\frac{1}{2}$ lb. of tobacco extract is diluted in the liquid to which a further 40 gals. of water is then added. In a separate container $7\frac{1}{2}$ lb. of soap is dissolved in 5 gals. of boiling water and this solution is mixed with the first one. Two sprayings are required, with a week's interval between them. If *A. persicae-niger* is the species present, the roots must be laid bare and sprayed also.

In order to facilitate the identification of the numerous species belonging to the genus *Aphis*, L., the author divides it into subgenera. As one of these, *Uraphis*, includes species with cylindrical and clubbed

siphons, the latter are now placed in the genus *Hayhurstia*, the type of which, *H. deformans*, sp. n., occurs on *Chenopodium* and *Atriplex* in Colorado. A key is given to the four genera, *Anuraphis*, Del Guerc., *Aphis*, L. (sens. strict.), *Uraphis*, Del Guerc., and *Hayhurstia*, Del Guerc.

The following species from Eritrea are figured and described:—*Macchiatiella trifolii*, sp. n., and *Aphis isabellina*, sp. n., on clover; *Aphis helianthi*, sp. n., *A. beccarii*, sp. n., on *Vicia fava*; *A. andreinii*, sp. n., on *Coreopsis*; *A. tavaresi*, Del Guerc.; *Uraphis sorghi*, Theo., on millet; *Macrosiphum sonchi* var. *flavomarginata*, n.; *Toxoptera aurantii* var. *limonii*, n., on lemon.

Italian Graminaceae are infested by *Sipha* spp., *Myzocallis* spp., *Aphis avenae*, F., *A. maidis*, Fitch, *A. maidi-radicis*, Forb., *A. hordei*, Del Guerc., *A. vulpiae*, Del Guerc., *A. rumicis* (*papaveris*, F.) and *Anuraphis poae*, sp. n., from the roots of *Poa annua*.

The Aphids which have been recorded as infesting citrus plants are *Macrosiphum* (*Siphonophora*) *citrifolii*, Ashm., *Toxoptera aurantii*, Koch., *Aphis tavaresi*, Del Guerc., *A. cookii*, Essig, *Anuraphis erratica*, sp. n., *Aphis citricola*, sp. n., *A. rumicis* (*papaveris*, F.), and *A. symphyti*, Schrank.

The concluding section of this paper records preliminary researches on the following root Aphids:—*Neorhizobius ulmiphilus*, sp. n., on *Ulmus americana* and *U. campestris*; *N. stramineus*, sp. n., on barley; *Eriosoma* (*Schizoneura*) *ulmi*, L., on currant and gooseberry; and the woolly apple aphis [*Eriosoma lanigerum*]. Among other factors in the spread of the last-named, Miss Patch has recorded the migration of the spring alatae from the elm to the apple. While leaving this matter open, as further experiments are being made, the author states that three years' experiments, conducted with the object of inducing this migration, have given negative results. Of millions of winged sexuparae migrating from apple trees in the second half of 1915 only a few stopped under the leaves of nearby elms and even these passed on without leaving sexual descendants while in the following spring no trace of galls was noticed on the new leaves. No better success attended an experiment in which sexuparae were enclosed with apple and elm plants. During this experiment, the alatae were seen to remain near the spot where they had developed, but on cutting the branches, where they had been feeding, they departed and not a single sexual individual nor a hibernating egg could be found. In June 1916 attempts were made to infest an apple tree with alatae from elm galls. The alatae issued from the galls and deposited their young on the leaves and branches of the apple, but all these died. The work is being continued in order to ascertain whether the cycle of this Aphid is completed on wild apple and wild pear, as on certain very small apple plants (*Pyrus pumila paradisiaca*) hibernating forms never recorded before, with the exception of one figured by Baker, were observed. Insecticides containing not less than 5 per cent. of tar oil are very efficacious, but for infestations of long standing, substances must be added which produce emanations injurious to the insects over a long period. Solutions containing unrefined commercial creosote are even better than tar oil and it is important that the roots be laid bare and that the excavation be drenched with the insecticide, which should also be poured on the excavated soil and this quickly replaced.

LEGISLATION.

Official Quarantine Notice. The White Pine Blister Disease.—*Pennsylvania Dept. Agric., Bur. Econ. Zool., Harrisburg*, Circ. no. 1, 15th March 1917. [Received 12th June 1917.]

This order prohibits, until further notice, the importation into Pennsylvania of any living white pine or other 5-leafed pine trees of any age. Violations of this order will be dealt with according to the provisions of the Act of 31st March 1905, which provides for the protection of plants against destructive insects and diseases.

Agricultural Ordinance, 1916, *Colony and Protectorate of Nigeria,* lv, 14th December 1916. [Received 25th June 1917.]

Under this Ordinance the Governor in Council has the power to make regulations to prevent the introduction or spread of any insect fungus or pest destructive to agricultural or horticultural crops, or other plants; to regulate the sowing, collecting, ginning or other preparation of cotton; to prohibit the importation or sowing of any particular kind of cotton seed or to specify any particular kind of seed as the only kind to be imported or used; to prohibit the use or exportation of any cotton of inferior quality or of any particular kind; to maintain or improve the quality of cotton in Nigeria; to provide for the appointment of inspectors and other officers to carry out the provisions of any such regulations.

Regulations made under the Agricultural Ordinance, 1916.—*Nigeria,* no. 8 of 1917, 13th March 1917. [Received 25th June 1917.]

These regulations provide that no cotton seed shall be imported into Nigeria except through the port of Lagos. Any cotton seed imported in contravention of this regulation shall be seized or destroyed. All cotton seed imported through the port of Lagos, unless covered by a certificate satisfactory to the Director of Agriculture that it has been properly disinfected before shipment, shall be detained and either destroyed or delivered to the Director of Agriculture for disinfection at the expense of the importer. The owner or occupier of any land in Nigeria on which cotton has been grown, except in the Provinces of Sokoto, Kano, Bornu, or Yola, shall uproot and burn all cotton plants in the Northern Provinces before 1st March and in the Colony and Southern Provinces before 1st April in each year. The penalty is a fine of £20. Any officer of the Agricultural Department may enter any cultivated lands for purposes of inspection and may order any infested plants or crops to be destroyed or treated under his supervision at the expense of the owner.

Amendment to the Destructive Insect and Pest Act Regulations of 4th November 1914.—*Order in Council, Ottawa,* 15th May 1917.

By this order, the list of insects included in the Destructive Insect and Pest Act of the Dominion of Canada is amended by the addition thereto of *Hyponomeuta malinellus* and *H. padellus* (the apple and cherry ermine moths).

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THE REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

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Gibson (A.). **Common Garden Insects and their Control.**—*Domin. Canada, Dept. Agric., Entom. Branch, Ottawa,* Circ. no. 9, April 1917, 20 pp. [Received 31st May 1917.]

This paper is a well-arranged and concise résumé of the facts concerning the occurrence and control of common insect pests in gardens.

The following formulae for the preparation of standard insecticides are given:—For biting insects—Paris green for liquid application, 4 oz. to 40 gals. water with about $\frac{1}{2}$ lb. fresh lime added; for dry application, 1 lb. Paris green mixed with 20 lb. of land plaster [*sic*], slaked lime or other perfectly dry powder, to be applied early in the morning when the plants are wet with dew. To render Paris green adhesive, 2 lb. resin and 1 lb. of sal soda (crystals) in 1 gal. water should be boiled together for one hour and added to the Paris green liquid for plants with waxy leaves, such as cabbages. This quantity is sufficient for 40 gals.

With arsenate of lead, 2 lb. powder or 4 lb. paste are used in 40 gals. water. For use in small quantities, 1 tablespoonful of the paste is sufficient for 1 gal. water.

Bordeaux mixture consists of:—Copper sulphate (bluestone) 4 lb., unslaked lime 4 lb., water (one barrel) 40 gals. To test this, let one drop of potassium ferrocyanide fall into the mixture, and if this turns reddish-brown add more milk of lime till no change takes place. When using Bordeaux mixture against the potato beetle [*Leptinotarsa decemlineata*], it must be poisoned by using either 6 lb. copper sulphate, 8 oz. or more of Paris green, 4 lb. of arsenate of lead paste to 40 gals. water, or preferably, 8 oz. Paris green and $1\frac{1}{2}$ lb. powdered lead arsenate to 40 gals. water.

Poisoned bran mixture, for cutworms and locusts is composed of:—Bran, 20 lb.; molasses, 1 quart; Paris green, $\frac{1}{2}$ lb.; water, 2 to 3 gals.

For sucking insects. Kerosene emulsion:—Kerosene (coal oil), 2 gals.; rainwater, 1 gal.; soap, $\frac{1}{2}$ lb. For small quantities use kerosene, 1 quart; flour, 8 oz.; water, 2 gals. Whale-oil or fish-oil soap should be used for brown or black Aphids at the strength of 1 lb. to 4 gals. water, and for green Aphids 1 lb. to 6 gals. water. Two widely-used trade preparations of tobacco extract are "Nickoteen" and "Black Leaf 40." It is advisable to add soap to these when diluted, at the rate of 2 lb. to 40 gals. of the mixture. Sulphur-soap mixture for red spider (*Tetranychus*) consists of flowers of sulphur, 1 oz.; laundry soap, 2 oz.; water, 1 gal.

Berlese (A.). *Aspidiotiphagus*, **How., e** *Prospaltella*, **Ashm.**—*Redia, Florence,* xii, no. 1–2, 25th April 1917, pp. 1–13.

This paper deals with the identity or otherwise of the Chalcid genera *Aspidiotiphagus*, How., and *Prospaltella*, Ashm., and the opinion is expressed that they should be kept distinct, though *Prospaltella lounsburyi*, Berl. & Paoli, is now placed in the former genus.

Malenotti (E.). *Metalaptus torquatus*, **n. gen. e n. specie di Calcidite.** [*Metalaptus torquatus*, a new Genus and Species of Chalcididae.]—*Redia, Florence,* xii, no. 1–2, 25th April 1917, pp. 339–341, 1 plate.

The Mymarid, *Metalaptus torquatus*, gen. et sp. n., from orange leaves attacked by *Chrysomphalus dictyospermi*, Morg., is here described.

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ROUBAUD (E.). **Les Insectes et la Dégénérescence des Arachides au Sénégal.** [Insects and the Deterioration of Ground-nuts in Senegal.]—Separate, undated, from *L'Ann. et Mém. du Com. d'Etudes hist. et scien. de l'Afrique occ. française* [sine loco], 1916, 76 pp., 14 figs. [Received 30th May 1917.]

During the winter of 1913, researches were made into the causes of deterioration of ground-nut crops in Senegal and as to the best remedy for it. This was found to be due not to degeneration of the strain owing to lack of selection of the seed, but to the ravages of insects. The variety of *Arachis* cultivated in Senegal is wonderfully hardy, perfectly adapted to the climate and soil, its selection having been brought about by natural causes long ago. The two chief causes of deterioration are the action of drought, the increasing lack of water not being entirely due to deforestation, and the lack of measures of control against insect pests. These interact and the insects mainly cause damage owing to lack of water.

The foliage is devoured by legions of beetles, crickets and grasshoppers, but the damage they do is negligible, compensation being effected by the extremely rapid growth of the plant. In July and the beginning of August, a small grasshopper, *Conipoda calcarata*, Sauss., is abundant, and is replaced later by Phasmids and locusts. A large grey weevil, *Anaemerus fuscus*, Ol., occurs at the base of the plants in the surface-soil. It does not attack the seeds, but sometimes appears to damage the ovaries of ripe flowers and the young pods; the larvae are more destructive than the adults. A green Noctuid caterpillar is very injurious, attacking the very young pods and the tap-root. It can be controlled by destroying the moths by means of large fires lighted at night, though this is difficult owing to lack of fuel. Other pests are the larvae of Elaterid beetles, Dipterous larvae of LEPTIDAE and EMPIDAE, Pimelia (TENEBRIONIDAE), and white grubs of the Melolonthids, *Schizonycha africana*, Cast., and *Anomala plebeja*, Ol., the Rutelid, *Adoretus umbrosus*, F., and the Dynastid, *Podalgus* (*Crator*) *cuniculus*, Burm. The plant survives injury by these when the soil is moist by throwing out a dense ring of adventitious roots above the point of injury, but during the dry season these cannot be formed to a sufficient extent to save it. A secondary pest is the Myriapod, *Peridontopyge perplicata*, only destructive in damp weather, which causes the parts of plants injured by other insects to decay. The larvae of the Tenebrionid beetles, *Zophosis* and *Homala*, also damage the nuts developing in the ground.

By far the most destructive underground pests are termites, of which the larger species, *Termes natalensis*, Hav., and *T. bellicosus*, Smeath., gnaw the pod without perforating it, though the smaller *Odontotermes vulgaris*, Hav., attacks the nuts themselves. *Eutermes parvulus*, Sjöst., is also very abundant, its prevalence being due to the fact that crops of ground-nuts and millet are grown alternately. The natives leave the stumps of the millet stems and the refuse to decompose in the ground as green manure, with the result that it becomes heavily infested with this termite. *E. parvulus* never attacks healthy plants, but only the roots damaged by other insects, and never attacks the fruits when dry and ripe, but only the freshly-formed ones in search of the moisture they contain. A small beetle, *Scydmaenus chevalieri*,

also bores a small hole in the pod for this purpose. The ants, *Monomorium bicolor*, Em., and *Dorylus fulvus*, Westw., do not attack nuts the pod of which is intact, but eat up the seeds in perforated ones. Another ant, *Euponera sennaarensis*, Mayr, is associated with Coccids on the young pods.

The remedy suggested for all the foregoing attacks is the prevention of the loss of water from the subsoil by keeping a few inches of the soil at the surface in a loose and powdery condition in order to reduce evaporation.

As regards the insects which attack the nuts after they have been gathered, injury may be inflicted at various times. The pods are gathered, stacked in ricks, threshed and after separation from the leaves are exposed to the air in large heaps. During these stages they are attacked by the Tenebrionid beetles, *Pimela angulosa*, Oliv., *P. senegalensis*, Oliv., *Homala polita*, Sol., *Zophosis elineata*, Cl., which attack only those seeds of which the pods are bruised or broken. Obviously this damage may be reduced by substituting the method of hand-picking for the destructive but easier process of threshing. While in the ricks, enormous damage is done by Rhynchota which suck out the oil from the nut. The most important is *Aphanus sordidus*, F., the ground-nut bug of Senegal, a Lygaeid, also recorded from India, China and Guinea. The insect bores invisible holes in the pod, and sucks out the oil from the nuts, leaving them wrinkled and withered. The attacks of this pest could be reduced, if not prevented, by the removal of all vegetation in the neighbourhood of the rick, and the covering of the latter at night with an awning. Other Rhynchota attacking ground-nuts are *Aphanus apicalis*, Dall., *Dieuches armipes*, F., and *Dysdercus* spp., especially *D. superstitiosus*, F.

In the closed storage sheds the nuts are attacked by the beetles, *Tenebroides mauritanicus*, L., and *Sylvanus mercator*, Fauv., which is perhaps only a form of *S. surinamensis*, L., and is important on account of its rapid reproduction, and power of existing without moisture; *Tribolium confusum*, Duv.; *T. castaneum*, Hbst.; *Alphitobius diaperinus*, Panz., and *A. piceus*, Ol.; Lepidoptera:—*Plodia interpunctella*, *Corcyra cephalonica*, Staint., and *Ephestia cautella*, Walk., the larvae of which are, however, controlled by the Braconid, *Habrobracon hebetor*, Say; Orthoptera: represented by one species of *Forficula*; Thysanura: *Thermobia domestica*, Pack. The Bruchid, *Pachymerus acaciae*, Gill., is the only pest that attacks and perforates the sound pods.

Control of these pests must be effected by fumigation, though none of the usual fumigants, carbon bisulphide, chloroform, hydrocyanic gas and cresol are suitable, owing to their dangerous nature, their expense, or the fact that they affect the oil in the nuts. The only gas suitable is the sulphurous vapour produced by burning sulphur or by means of the Clayton apparatus; this is cheap, easily applied, and has no injurious effect on the oil.

FEYTAUD (J.). **La Défense de la Vigne contre les Insectes.** [The Protection of the Vine against Insects.]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xvi, no. 5, May 1917, pp. 33–42.

This paper contains a résumé of the life-histories and habits of the principal vine pests in France, and the methods of their control.

Haltica ampelophaga hibernates as an adult under the bark, emerging and migrating to the young shoots in April. Oviposition occurs in May, the larvae devouring the foliage in May and June and transforming to adults of the second generation in June and July. The next generation, which becomes adult at the end of the summer, is that which passes the winter under the bark. Controls for this flea-beetle are the burning of artificial shelters during the winter; the use in spring of repellent dust-sprays of sulphur and naphthaline or sulphur and nicotine or of arsenical solutions to drive away the adults and prevent oviposition; the removal of leaves bearing eggs or young larvae; the collection of adults in early spring, before oviposition occurs, by means of bait-traps; and the protection of natural enemies, particularly the blue bug, *Zicrona coerulea*. *Byctiscus betulae* (*Rynchites betuleti*) hibernates in the ground in the adult stage, appearing on the branches in May and rolling the leaves into a cylinder in which the females oviposit. The larvae mature in the rolled-up leaves, transforming into the adult in the ground at the end of summer. The only practical control of this weevil is to collect and burn the rolled-up leaves on two or three occasions during June. *Otiorrhynchus sulcatus* occurs as a larva in the soil during the winter, having developed during the summer and autumn on the vine-roots, and in the early spring re-commences its attacks. Pupation occurs in April and May, and in May and June the weevils appear attacking the shoots. Eggs are deposited just under the surface of the soil. The larvae can be destroyed in the ground by injections of carbon bisulphide; this is an expensive method, the success of which is doubtful in sandy soil. Repellent sprays round the infested area prevent the spread of the pest. The most successful measure is the collection of adults in June and July, either in the day-time by shelter-traps, or at night by means of trap-lamps.

Eulecanium persicae, the most formidable scale-insect attacking vines in France, passes the winter on the old stocks, or on the last year's growth. Insecticides will destroy some of the larvae on the leaves during the summer, but the most effective control consists of washes on the old wood and new growth during the winter. The formula recommended is: heavy tar-oil, 5 to 10 lb.; fat lime, 20 lb.; water, 10 gals. The lime is slaked with a little water; as soon as it begins to form a powder the oil is poured on to it. The mixture should be stirred occasionally until the oil is well mixed in. Application should be made with a brush.

Cutworms are controlled by injections of carbon bisulphide into the soil during the winter, or by sulphur or repellent sprays. Collection of larvae should be made in the day-time at the foot of the trunks and under artificial shelters, or at night on the branches. The adult moths can be captured during the summer with baits. *Arctia* (*Chelonia*) *caja* occurs on weeds and undergrowth during the spring and later in the season sometimes attacks vine-shoots. Strips of ground left unworked and unhoed check infestation of the vine to a certain extent. The bionomics and control of the vine-moths, *Sparganothis pilleriana*, *Clysia ambiguella* and *Polychrosis botrana*, which have been frequently dealt with in this *Review*, are given in detail.

Natural enemies which destroy these pests should be protected as a first means of defence. They include mammals such as moles,

shrewmice, hedgehogs, bats; birds, including swallows and tomtits; as well as lizards, toads and various spiders. Among insects, Carabid beetles are predaceous on the larvae of *S. pilleriana*, cutworms and Arctiids, and on *Otiorrhynchus*, which is also attacked by the larger Staphylinids. The larvae of Malachiid and Clerid beetles prey upon the larvae and pupae of vine-moths hibernating under the bark. Coccinellids destroy the Coccids and the young vine-moth larvae.

Among predaceous Hymenoptera, *Eumenes* and *Odynerus* provision their nests with young larvae of *Haltica ampelophaga*, *Ammophila* spp. attacking the caterpillars of Noctuids, and *Cerceris* spp. preying on *Otiorrhynchus*. Parasitic Hymenoptera include the Ichneumonids, *Ichneumon melanogonus*, parasitic on *S. pilleriana*, and *Pimpla alternans* and *Agrypon flaveolatum*, parasitic on all three vine-moths; the Braconids, *Microgaster* (*Apanteles*) *cajae* attacking *Arctia caja*, *Meteorus pallidus* infesting cutworms, and *Perilitus brevicollis*, an enemy of *Haltica ampelophaga*; the Chalcidids, *Pteromalus* spp. attacking the larvae of *S. pilleriana*, *Monodontomerus aereus* those of *C. ambiguella* and *P. botrana*, and *Oophthora semblidis* parasitising the eggs of all three species.

Dipterous parasites include the Tachinids, *Degeeria funebris*, parasitic on *H. ampelophaga*, *Parerynnia vibrissata* on *S. pilleriana*, and *Echinomyia prompta* on the caterpillars of Noctuids. Bacilli and fungi also play a part in the control of vine insects, Arctiid larvae being attacked by *Bacillus cajae* and *Empusa aulicae*. Adults of *Haltica* are attacked in winter by *Sporotrichum globuliferum*, and the chrysalis of *C. ambiguella* by *Isaria farinosa*.

The technique of the various treatments is described. Winter decortication has for its object the removal and destruction of the old bark in order to destroy the insects which it shelters. To be successful, a sheet should be spread on the ground with a hole cut in it for the stock. Hot-water treatment is applied in winter by means of a boiler mounted on a cart which contains boiling water; this is sprayed over the branches, either by means of rubber tubes connected with the boiler and supplied with jets, or by cafetières with double walls. The liquid repellents or insecticide sprays recommended have already been described [see this *Review*, Ser. A, iv, p. 299]. In preparing arsenical sprays, it is now necessary to buy arsenate of lead in the form of a prepared powder or paste which is simply diluted in water. The proportion of arsenate of lead contained in these commercial products varies according to the brand, and this should be ascertained before preparing the mixture. For example, the quantity of neutral arsenate of lead required to be used compared with that of disodic orthoarsenate is about 2·4 times as much, i.e., one oz. of disodic orthoarsenate of lead when completely transformed into neutral arsenate of lead gives 2·4 ozs. of this salt. Therefore the old formula, anhydrous sodium arsenate 2 lb., neutral lead acetate 6 lb., water 100 gals., would correspond to $2 \times 2{\cdot}4 = 4{\cdot}8$ lb. per 100 gals., or with the formula containing 3 lb. anhydrous sodium arsenate, 7·2 lb. per 100 gals. In round figures, an arsenical mixture based on lead arsenate should contain 5 to 7 lb. of this salt per 100 gals., the greater strength being the more usual. Many of the commercial preparations sold for the purpose of making arsenate of lead sprays may be recommended, but in order to obtain the necessary 5–7 lb. of lead arsenate per 100 gals.,

10–14 lb. of such preparations must be used. The arsenical pastes likewise usually contain only about 50 per cent. of the necessary quantity of lead arsenate. Both arsenate of lead and nicotine may be mixed with copper solutions, but in this case the insecticide should be diluted with a little water before adding to the copper.

Bait-traps and their use have been fully described by the author in previous papers [see this *Review*, Ser. A, iv, pp. 309 and 492, and v, p. 136].

The organisation of syndicates for the purpose of co-operation in control in cases of wide-spread infestation by vine pests is advised.

Durante (D.). **Contributo alla Conoscenza biologica della *Tingis pyri*, F.** [A Contribution to the Knowledge of the Biology of *Tingis pyri*.] Separate, dated 10th May 1917, from *Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric., Portici*, xi, pp. 282–290.

The observations here recorded were made in the spring of 1914, on apple trees on which an outbreak of *Tingis pyri*, F., had occurred in the previous summer. The first adults appear on the under-side of the leaves soon after the buds open and oviposit shortly afterwards. The total time required by the first generation from egg to adult is 32–46 days. Oviposition by the hibernating adults continues even after the new adults appear. Among the plants cultivated in Italy those usually attacked are the apple and pear ; a case was also noticed where infestation from apple trees passed to a plum tree near by. At Somma Vesuviana the larval and nymphal stages of the *Tingis* were attacked by a small bug and by a Neuropteron.

The following sprays were found suitable against this pest :— Petroleum 1 lb., soft soap 1 lb., water 10 gals., or soap 2 lb., water 10 gals. A third formula, containing soft soap 1 lb., carbolic tobacco extract 1 lb., water 10 gals., proved more costly. The trunks of the trees should be kept clean, so as to deprive the adults of shelter in winter.

Voglino (P.). **Le Tignole della Vite.** [The Vine Moths.]—*Riv. Agricoltura, Parma*, xxiii, no. 20, 18th May 1917, pp. 274–276.

This is a popular article on the vine moths, *Clysia ambiguella* and *Polychrosis botrana*, and contains no new information.

Mackay (A. H.). **Address.**—*Proc. Entom. Soc. Nova Scotia for 1916, Truro*, no. 2, January 1917, pp. 7–9. [Received 2nd June 1917.]

The author calls attention in this address to the enormous financial loss caused by insects in North America. The Canadian lumber industry is damaged annually to the extent of 25 to 75 million dollars by insects which bore into the wood or bark or otherwise injure the forests. In the United States this damage exceeds 100 million dollars a year, while the total injury by insects to crops, cattle, forest trees, etc. amounts to one billion dollars annually. The damage caused by the Hessian fly [*Mayetiola destructor*] alone has amounted to 40 million dollars annually ; the cotton-boll weevil [*Anthonomus grandis*] is responsible for injury amounting to 30 million dollars, the codling moth [*Cydia pomonella*] for 15 million, and the chinch bug [*Blissus*

leucoptera] for seven million; besides which the gipsy [*Lymantria dispar*] and brown-tail moths [*Euproctis chrysorrhoea*], the San José scale [*Aspidiotus perniciosus*] and other insects cause a high percentage of loss.

Brittain (W. H.). **Some Results from a Few Combination Sprays in 1916.**—*Proc. Entom. Soc. Nova Scotia for 1916, Truro,* no. 2, January 1917, pp. 9–12. [Received 2nd June 1917.]

This paper summarises by means of tables the results of various combination sprays used during the year. Soluble sulphur (sodium sulphide) and barium sulphur (barium tetrasulphide), two commercial preparations sold in powdered form as substitutes for lime-sulphur, appear to be inferior in fungicidal value to the latter preparation, while both were found to injure foliage.

Brittain (W. H.). **The Nova Scotia Division of Entomology.**—*Proc. Entom. Soc. Nova Scotia for 1916, Truro,* no. 2, January 1917, pp. 15–17. [Received 2nd June 1917.]

Entomological work in Nova Scotia is reviewed since the year 1912, when a Provincial Entomologist was appointed after *Euproctis chrysorrhoea*, L. (brown-tail moth) and *Aspidiotus perniciosus*, Comst. (San José scale) had been discovered in the Province. Inspection and fumigation have been thoroughly carried out under the regulations of the Act of 1911. Investigation work has been extended, laboratories being established with insectaries attached. One of these is situated in a centre of infestation by *Rhagoletis pomonella* (apple maggot) and another deals with experimental work on *Lygus communis* var. *novascotiensis*, Knight (green apple bug). The various sucking insects that attack apple and pear have received special attention and various bulletins have been published on the information obtained Demonstration work and educational classes have also been held, and a representative collection of Nova Scotian insects has been begun. An inspector of apiaries has been appointed and general entomological work has been efficiently conducted.

Sanders (G. E.). **The Effect of Certain Combinations of Spraying Materials on the Set of Apples.**—*Proc. Entom. Soc. Nova Scotia for 1916, Truro,* no. 2, January 1917, pp. 17–21. [Received 2nd June 1917.]

Owing to the frequency of damage reported in consequence of spraying apples with lime and sulphur, experiments were undertaken to test the injury caused by the use of various strengths of lime-sulphur solution, and at what strength it began to cause dropping of the apples. In all cases the trees sprayed with even the most dilute solutions of lime-sulphur gave fewer apples than unsprayed trees. The fruit from the unsprayed trees was, however, almost worthless owing to insect injury and fungus diseases, so that these results do not constitute any argument against spraying, but rather indicate the desirability of more dilute solutions of lime-sulphur and the further investigation of the material with the idea of rendering it harmless.

Tables are given showing the results of the various treatments. Lime-sulphur at one gal. concentrated to 33 of water does but little harm before blossoming; after blossoming, it possibly reduces the quantity of apples somewhat, but does not cause the russeting characteristic of Bordeaux mixture. The greatest damage is done two weeks after blossoming, while at this time Bordeaux mixture is comparatively harmless, in so far as russeting of the fruit or dropping is concerned.

Taking the previous years' results into consideration and reckoning the cost of materials, the best and most economical combination of materials would seem to be :—before the blossoms, lime-sulphur with arsenate of lime in a weaker solution than that used in any of the experiments, viz. :—1 to 75; immediately after the blossoms, about 1 gal. commercial concentrate of lime-sulphur to 50 gals. water, with a reduced quantity of arsenate of lime; two weeks after the blossoms, a very weak Bordeaux mixture.

An orchard sprayed almost exactly according to this plan gave very successful results.

GOODERHAM (C. B.). **The Acrididae of Nova Scotia.**—*Proc. Entom. Soc. Nova Scotia for 1916, Truro*, no. 2, January 1917, pp. 21–30, 1 plate. [Received 2nd June 1917.]

This purely systematic paper describes all the genera and species of ACRIDIIDAE occurring in Nova Scotia, and gives their geographical distribution within the province.

BRITTAIN (W. H.). **Notes on the Apple-seed Chalcis.**—*Proc. Entom. Soc. Nova Scotia for 1916, Truro*, no. 2, January 1917, pp. 30–31, 1 plate. [Received 2nd June 1917.]

Serious damage due to *Syntomaspis druparum*, Boh. (apple-seed Chalcid) is fortunately only local at present in Nova Scotia. Crab-apples, as well as several varieties of cultivated apples, are attacked and the same or a related species attacks the fruit of the hawthorn (*Crataegus*). It is not likely however to become a serious pest, since its damage to the fruit is very slight and apple-seeds have no commercial value. The only possible control seems to be the collection and destruction of all wind-falls in infested districts in the autumn [see also this *Review*, Ser. A, v, p. 122].

SANDERS (G. E.). **Biting Insects injuring the Fruit of the Apple in Nova Scotia.**—*Proc. Entom. Soc. Nova Scotia for 1916, Truro*, no. 2, January 1917, pp. 31–33, 1 plate. [Received 2nd June 1917.]

This paper contains detailed descriptions of the injuries to apples caused by *Eucosma (Spilonota) ocellana*, Schiff. (eye-spotted bud-moth), *Olethreutes consanguinea*, Wlsm. (larger bud-moth), *Cacoecia (Archips) rosaceana*, Harris (oblique-banded leaf-roller), the fruit worms, *Graptolitha (Xylina) bethunei*, G. & R., *G. antennata*, *G. cinerosa*, *G. laticinerea*, *G. georgii*, *Conistra (Scopelosoma) tristigmata*, *Xylina (Calocampa) nupera*, and *X. (C.) curvimacula*, of which the first is more numerous than all the rest together, the

tussock-moth [*Hemerocampa*], codling-moth [*Cydia pomonella*], and *Taxonus glabratus* (*nigrosoma*) (dock saw-fly).

The usual control measures are given, special stress being laid on the mechanical value of high-pressure spraying.

BRITTAIN (W. H.). **Notes of Two Species of Tree-hoppers (Membracidae) ovipositing in the Apple.**—*Proc. Entom. Soc. Nova Scotia for 1916, Truro*, no. 2, January 1917, pp. 34–39. [Received 2nd June 1917.]

Ceresa taurina, Fitch, oviposits in the buds of apple trees, but as it never causes any injury to the bud, even in extreme cases, it cannot be considered of economic importance. The closely allied species *C. bubalus*, F. (the buffalo tree-hopper), which oviposits in the twigs and smaller limbs, may, however, cause serious secondary damage owing to the scars made thereby affording suitable conditions for the entrance of boring insects and wood-destroying fungi.

SANDERS (G. E.). **Arsenate of Lead versus Arsenate of Lime.**—*Proc. Entom. Soc. Nova Scotia for 1916, Truro*, no. 2, January 1917, pp. 40–45. [Received 2nd June 1917.]

A spraying mixture of lead arsenate and lime-sulphur has been found unsatisfactory in practice owing to the chemical reactions resulting in the formation of lead sulphide, which settles on the bottom of the tank and prevents the proper agitation of the liquid, while it clogs the nozzles and removes over 35 per cent. of the sulphur from solution, 5 per cent. of the arsenic oxide at the same time becoming soluble [see this *Review*, Ser. A, iii, pp. 655–657]. This would be obviated by the use of calcium arsenate, guaranteed to contain less than 1 per cent. soluble arsenic, as there is no reaction between the arsenates of calcium, barium or strontium and sulphide solutions. Arsenate of lead used alone is quite harmless to foliage, but mixed with lime-sulphur is much more injurious than a mixture of arsenate of lime and lime-sulphur. On the other hand arsenate of lime by itself causes the most severe burning owing to the greater affinity of calcium for carbon than for arsenic. Hence in the presence of the carbon dioxide of the leaf, calcium carbonate is formed and arsenic is liberated in the form of arsenic acid.

As regards the effect of these two arsenates when mixed with sulphides other than lime-sulphur, experiments have shown that in the case of barium tetrasulphide, a solution of dry (acid) lead arsenate 1 lb. to 40 gals., and barium tetrasulphide 3 lb. to 40. gals., slightly scorched 50 per cent. of the leaves; while a mixture of dry arsenate of lime $\frac{3}{4}$ lb. to 40 gals. and barium tetrasulphide 3 lb. to 40 gals., slightly scorched 2 per cent. of the leaves. The combination of sodium sulphide with lead arsenate usually results in scorching all the leaves more or less, owing to the formation of soluble sodium arsenate, but with calcium arsenate a harmless mixture is formed that can be applied three or four times to strongly growing trees. Repeated application to slow-growing trees, however, seems to result in the poisoning and yellowing of the leaves. It still remains an open question whether lead arsenate or calcium arsenate in a lime-sulphur solution has the greater fungicidal value.

Dustan (A. G.) & Gilliatt (F. C.). **The Dock Sawfly.**—*Proc. Entom. Soc. Nova Scotia for 1916, Truro*, no. 2, January 1917, pp. 45–48, 1 plate. [Received 2nd June 1917.]

While this paper was in the press, Bull. 265 of the U.S. Dept. of Agric. was published [see this *Review*, Ser. A, v, p. 241]. The dock sawfly, *Taxonus glabratus*, Fall. (*nigrosoma*, Nort.), does most damage in young orchards, where 100 per cent. of the larvae hibernate in the fruit, as many as five being found in one apple. In old orchards, however, 75 per cent. hibernate in soft dead wood, in old bark and in crevices. The injury to the fruit is serious, as the entrance hole and cell made by the larva are surrounded by a large area of discoloured and decayed flesh.

Brittain (W. H.) & Saunders (L. G.). **Notes on the Rose Leaf-hopper (*Empoa rosae*, Linn.) in Nova Scotia.**—*Proc. Entom. Soc. Nova Scotia for 1916, Truro*, no. 2, January 1917, pp. 48–51, 1 plate. [Received 2nd June 1917.]

The rose leaf-hopper is not so serious a pest in Nova Scotia as it has been reported to be in the North-west of America [see this *Review*, Ser. A, iii, pp. 270], though the author considers it probable that injuries due to it have been attributed to *Empoasca mali* (the apple leaf-hopper). The chief enemies of both these species are probably egg-parasites. A large proportion of eggs of *Empoa rosae* dissected from their blisters have been found to be attacked by a minute Hymenopterous parasite, not yet identified.

Brittain (W. H.). **Notes on the Rosy Aphis (*Aphis malifoliae*, Fitch) in Nova Scotia.**—*Proc. Entom. Soc. Nova Scotia for 1916, Truro*, no. 2, January 1917, pp. 51–55, 1 fig. [Received 2nd June 1917.]

Aphis malifoliae (the rosy aphis) lays its eggs in smaller numbers and less conspicuous places than the green aphis [*A. pomi*]. They are usually all hatched by the first or second week in May and the stem-mother reaches maturity during the last week in May or the first in June. The reproductive period lasts from two to six weeks, the average number of young produced under insectary conditions being 184. Normally, in Nova Scotia there is only one complete generation on the apple after the stem-mother, the third generation being winged and migrating to the secondary host-plants, *Plantago lanceolata* and *P. major*. Experiments point to the development of a winged third generation being influenced by overcrowding. The summer forms on the plantain are not so prolific as the spring ones on the apple, and produce migrants in the sixth to ninth generations that return to the apple.

Sanders (G. E.) & Brittain (W. H.). **The Toxic Value of some Common Poisons alone and in Combination with Fungicides, on a few Species of Biting Insects.**—*Proc. Entom. Soc. Nova Scotia for 1916, Truro*, no. 2, January 1917, pp. 55–64, 11 tables. [Received 2nd June 1917.]

The result of numerous experiments on larvae of the brown-tail moth [*Euproctis chrysorrhoea*] to test the killing power of arsenical

poisons used in combination with various fungicides shows that the toxic action is reduced by barium tetrasulphide and sodium sulphide used together (by 6·4 per cent.), by lime-sulphur (by 19·2 per cent.), and by Bordeaux mixture (by 43·5 per cent.), while on the other hand it was increased 13·1 per cent. by the use of sodium sulphide. It is not yet determined whether this action of sodium is due to the increased palatability of the leaves on which the insects feed voraciously, or to the chemical reaction resulting in the formation of sodium arsenate and a metallic sulphide.

BRITTAIN (W. H.). **Sucking Insects and Mites injurious to the Apple and Pear.**—*Nova Scotia Coll. Agric., Truro,* Circ. no. 17, 1917, 15 pp. [Received 4th June 1917.]

This circular briefly notices and recommends controls for the following sucking insects :—*Lygus communis* var. *novascotiensis* (green apple bug), [see this *Review*, Ser. A, iv, pp. 96, 520, and v, p. 194], *L. pratensis* (tarnished plant bug), *Lygidea mendax* (false apple red bug), *Idiocerus fitchi*, Van D. (black apple leaf-hopper), *Empoa rosae*, L. (rose leaf-hopper), *Empoasca mali*, Le B. (apple leaf-hopper), *Aphis pomi*, De G. (green apple aphis), *A. sorbi*, Kalt. (rosy apple aphis), *Aphis* (*Siphocoryne*) *avenae*, F. (grain aphis), *Eriosoma lanigerum*, Hausm. (woolly apple aphis), *Lepidosaphes ulmi*, L. (oyster-shell scale), *Psylla pyricola*, Forster (pear psylla), *Eriophyes pyri*, Pgst. (pear-leaf blister mite), and *Phyllocoptes schlectendali*, Nal. (apple leaf-mite).

BRITTAIN (W. H.). **Legislation in Force in Nova Scotia to prevent the Importation and Spread of Insects and Diseases injurious to Plants.** —*Nova Scotia Coll. Agric., Truro,* Circ. no. 23, 1917, pp. 12. [Received 4th June 1917.]

The legislation here noticed has already been recorded [see this *Review*, iii, p. 71]. To the list of the insects subject to the Act, the names of two additional species, *Rhagoletis cingulata* and *R. fausta* (cherry fruit-flies), are added.

HEWITT (C. G.). **The Introduction into Canada of the Ichneumon Fly,** *Mesoleius tenthredinis*, **a parasitic Enemy of the Larch Sawfly,** *Nematus erichsonii*.—*Agric. Gaz. Canada, Ottawa,* iv., no. 5, May 1917, pp. 355–357, 1 fig.

Following on the destruction of the tamarack or larch trees throughout Eastern Canada a few years ago owing to heavy infestation by *Lygaeonematus* (*Nematus*) *erichsoni* (the larch sawfly), the plan was adopted of importing cocoons of this sawfly parasitised by *Mesoleius tenthredinis*, an Ichneumonid which controls this pest in Europe, whence the sawfly had been introduced into Canada. This paper describes the introduction and establishment of the parasite, which was begun in 1911. In 1913, larch sawflies, which were abundant in a larch swamp where the parasite had been distributed, were found parasitised to the extent of 68 per cent. *Hypamblis albopictus* and *Microcryptus labralis*, other parasites of *L. erichsoni* were also found on this occasion. By the spring of 1916, *M. tenthredinis* had become thoroughly established, and affords proof of the success of biological methods of control for certain insect pests.

Hewitt (C. G.). **Corrections in Entomological Records.**—*Agric. Gaz. Canada, Ottawa,* iv, no. 5, May 1917, pp. 357–358.

The author points out that on p. 818 of the Agricultural Gazette of Canada, for October 1914, i, no. 10, in a paper by J. W. Eastham [see this *Review*, Ser. A, iii, p. 71], the army worm, *Cirphis* (*Heliophila*) *unipuncta,* is recorded as having done considerable damage in British Columbia and as being parasitised by Braconids and Tachinids. The insect referred to was not, however, *C. unipuncta,* but probably *Phytometra* (*Plusia*) *californica.* The importance of verifying reports regarding the occurrence of insects is urged, in order to avoid mistakes in entomological literature.

Berry (W.). **A Chair of Economic Ornithology.**—*Scottish Naturalist, Edinburgh,* no. 66, June 1917, pp. 121–135.

The author, while advocating a great reduction in the numbers of sparrows, protests against their wholesale destruction, pointing out that a systematic examination of nearly 300 sparrows, mostly from a fruit-growing district, showed that the great bulk of the food carried to the nestling young consists of weevils and the larvae of other noxious insects. The black-headed gull was also found to be a land-feeder; 22 nestlings were examined and an analysis of their food showed the remains of two small fish, 33 useful beetles, 6 earthworms, 51 harmful beetles and other insects, as well as 31 wireworms.

As regards the pheasant, the crop of one individual killed in marshy ground contained nearly 200 wireworms, and exhaustive analyses of the crop contents of 183 pheasants obtained from all parts of the country and at various times of the year have disclosed the remains of over 100,000 injurious beetles and other insects, a varied assortment of vegetable refuse, 421 wild berries, weed seeds, etc., and only 37 husks and fragments of corn. The examination of the crop of one young cock pheasant from Argyllshire yielded—Diptera: *Bibio lepidus,* 2,286 specimens; Coleoptera: *Lochmaea suturalis* (heather beetle), 508 specimens; ants and grasshoppers, 6. *Lochmaea suturalis* is particularly destructive, rendering patches of heather, varying in size from a few square yards to thousands of acres, entirely useless as food, for cattle, sheep, or grouse. Only two methods of control are suggested, one, that of burning the heather in the height of the summer, being likely to prove more injurious to the grazing value of the moors, as well as to the grouse, than the results would justify; the other being the protection of black game and pheasants, which both devour the beetles by thousands, while grouse never touch them. In spite of this, both black game and pheasants have been recommended for wholesale destruction by the Board of Agriculture.

A Plague of Caterpillars.—*Gardeners' Chronicle, London,* lxi, no. 1589, 9th June 1917, p. 229.

Apple and pear trees in the south of England, after apparently promising a record fruit crop in 1917, were suddenly attacked by the worst infestation of caterpillars known for 17 years. The most numerous species are the common tissue moth (*Scotosia dubitata*), the brindled beauty moth [*Phigalia pedaria*], the winter moth [*Cheimatobia*

brumata], the clouded drab moth [*Taeniocampa incerta*], the mottled umber moth [*Hybernia defoliaria*], with smaller numbers of the lackey moth (*Malacosoma neustria*), and the little ermine moth [*Hyponomeuta padellus*]. At the same time, the apple sawfly [*Hoplocampa testudinea*] and hairy caterpillars have been conspicuous by their absence, and there has been only a very small proportion of winter moth larvae. As a control, arsenate of lead or a mixture of lead arsenate and sulphur should be applied just before the buds open. If deferred till the blossom is out, there is the danger of poisoning the pollen for bees. This does not apply to plums, as there is nothing for the poison to cling to until the blossom is partly open.

The Caterpillar Plague.—*Gardeners' Chronicle, London,* lxi, 1591, 23rd June 1917, p. 255.

The winter moth [*Cheimatobia brumata*], the umber moth [*Hybernia defoliaria*], the March moth [*Anisopteryx aescularia*], the pepper and salt moth [*Amphidasys betularia*], the clouded drab moth [*Taeniocampa incerta*], and several species of *Tortrix*, were found on apple and pear trees in Kent in the spring of 1917. Opinion is divided as to the use of greased banding, as this is difficult to fix in such a way that minute larvae cannot crawl under it. Lead arsenate spraying has however proved very successful. Experience has shown that the moths do not travel far in search of a host-plant. Hedges in or near orchards are very dangerous as breeding grounds.

THEOBALD (F. V.). **The Caterpillar Attack on Fruit-trees.**—*Nature, London,* xcix, no. 2486, 21st June 1917, p. 326.

Apples, cherries and plums in Kent, Sussex, Hereford and Worcester, have been attacked by *Cheimatobia brumata* (winter moth), *Hybernia defoliaria* (mottled umber moth), and *Phigalia pedaria* (*pilosaria*) (the pale brindle beauty moth), the worst damage having been done in plantations near oak woods. *Anisopteryx aescularia* (March moth) has been reported in comparatively small numbers. From several localities increasing damage due to *Taeniocampa incerta* (*instabilis*) (clouded drab moth), and the continued attacks of *Malacosoma* (*Clisiocampa*) *neustria* (lackey moth) and *Hyponomeuta padellus* (little ermine moth) have been notified. The loss incurred has been due to lack of skilled labour for banding and spraying, and also to the great winter mortality among sparrows, which, when nesting, devour the larvae of the winter moth and keep it in check.

A. C. B. **The Celery Fly and Parsnips.**—*Gardeners' Chronicle, London,* no. 1592, 30th June 1917, p. 261.

Owing perhaps to drought and to late sowing, the larvae of *Acidia heraclei*, L. (*Tephritis onopordinis*, Curtis), the celery fly, have seriously attacked young parsnip leaves. As there may be as many as six generations in the season, immediate control measures should be undertaken. In small plants, the brown patches on the leaves may be squeezed to kill the larvae, but in large plants it is better to cut off and destroy the whole leaf. Dusting the plants, while still damp, with soot or powdered lime, or spraying with quassia extract or with paraffin emulsion at regular intervals, give good results.

TRUELLE (A.). **L'Emploi de l'Arseniate de Plomb comme Insecticide.** [Lead Arsenate as an Insecticide.]—*Vie Agric. et Rur., Paris*, vii, no. 22, 2nd June 1917, pp. 377–382.

The history and method of use of lead arsenate as an insecticide both in the United States and in France are dealt with at length. The legal restrictions existing in France since the 30th December 1916 are quoted, and general formulae for the use of lead arsenate powder, Swift's arsenate and English lead arsenate paste are given.

BERNARD (L.). **Les Insectes Nuisibles aux Vergers. La Chématobie.** [Destructive Orchard Insects. The Winter Moth.]—*Vie Agric. et Rur., Paris*, vii, no. 22, 2nd June 1917, pp. 383–385.

The only satisfactory method of controlling this formidable pest [*Cheimatobia brumata*] is by the use of adhesive bands round the trunk. M. Truelle gives two formulae for the preparation of the substance used: (1) One pound of colza oil and one pound of lard are heated together till the volume is reduced to one-third, the same weight of both turpentine and black resin is then added and the whole stirred till thoroughly mixed. (2) One pound of black resin and $1\frac{3}{8}$ pounds of tar are heated carefully in an iron vessel till thoroughly mixed; one pound of black soap and then 10 ounces of fish oil are added; the mixture is then taken from the fire and stirred until cold. It must be applied to bands of strong packing- or parchment-paper, 10–12 ins. wide and long enough to encircle the tree-trunk. Each band must be firmly fixed at its upper and lower edges by means of strong string or iron wire, in such a manner that no insects can crawl underneath it.

ROLET (A.). **La Lutte contre les Cochenilles des Orangers et autres Agrumes.** [The Control of the Coccids of Orange-trees and other Citrus Plants.]—*Vie Agric. et Rur., Paris*, vii, no. 22, 2nd June 1917, pp. 386–389.

The most important scale-insect attacking oranges in the south of France is *Chrysomphalus* (*Aspidiotus*) *dictyospermi* var. *pinnulifera*, which is very destructive, but does not cause sooty fungus. *C.* (*A.*) *adonidum*, the American red-scale, does not occur in France, though its presence in Algeria has been reported. *Pseudococcus citri* is common in the south and in Algeria. *Lepidosaphes beckii* (*Mytilaspis citricola*) has been reported in Alpes-Maritimes, as well as *Coccus hesperidum*, which is particularly liable to cause sooty fungus. *Ceroplastes sinensis* has been recorded at Nice on mandarin trees, while *Parlatoria ziziphus* is very destructive in Algeria.

The first step in control lies in careful pruning and thinning so as to improve the general health of the trees. This may be followed by powerful spraying in winter with a strong solution, such as 5 lb. of black soap in one gallon of water, or a lime-sulphur wash. The efficacy of simple milk of lime does not lie only in its causticity, but in the fact that it shrinks in drying and loosens the shield, thus killing the insect.

The following insecticides are also recommended:—8 lb. of black soap are dissolved in 3 gals. of boiling water and, when this has cooled to about 104° F., 2 gals. of petrol are slowly added, while stirring;

$1\frac{3}{4}$ pints of this emulsion should be used in 3 gals. of water as required. The "pitteleina de Berlèse" and "rubina" are emulsions of tar in caustic potash or soda, which are used in the proportion of 1 to 5 per cent. for the former and 1 to 3 per cent. for the latter. "Antilles liquid" is composed of 20 lb. of commercial powdered resin, 5 lb. of caustic soda and $2\frac{1}{2}$ pints of fish oil, with water to make 100 gals. The alkaline polysulphides of commerce are used in the proportion of 2 to 3 per cent. in water immediately after mixing, as they decompose readily.

PARMENTIER (P.). **Les Maladies du Noyer.** [Diseases of the Walnut.]—*Vie Agric. et Rur., Paris*, vii, no. 22, 2nd June 1917, pp. 393–398.

The insect pests of walnuts include :—The boring larvae of *Taphrorhynchus* (*Bostrychus*) *bicolor* and the Longicorn, *Saperda scalaris*, both of which can be controlled only by pruning and burning the infested branches on the spot; *Aphis juglandinis* and *Lachnus juglandis* attack the young leaves, and the Coccid, *Eulecanium* (*Lecanium*) *juglandis*, forms galls on the twigs and branches.

The Lepidopterous pests include :—*Dasychira* (*Orgyia*) *pudibunda*, *Stauropus* (*Harpyia*) *fagi*, *Gracilaria juglandella*, *Saturnia pyri*, *Chematobia brumata*, attacking the foliage, *Cossus cossus* (*ligniperda*) and *Zeuzera pyrina* (*aesculi*), the larvae of which bore the branches, and *Cydia pomonella* (*Carpocapsa pomonana*), the caterpillar of which destroys the inside of the nuts.

GUÉNAUX (G.). **Traitements de Printemps et d'Eté contre la Cochylis et l'Eudémis.** [Spring and Summer Treatments for *Clysia ambiguella* and *Polychrosis botrana*.]—*Vie Agric. et Rur., Paris*, vii, no. 22, 2nd June 1917, pp. 397–398.

The treatment recommended in spring is spraying with lead arsenate, which must be replaced in summer, when the grapes are forming, by a nicotine solution. The formula recommended for the latter is :—Ordinary Bordeaux mixture 20 gals., titrated extract of nicotine $1\frac{1}{8}$ pints, ordinary soap 4 lb. The Bordeaux mixture is composed of : 20 gals. water, 4 lb. copper sulphate, and 2 lb. of fat lime. The nicotine solution is added to this and then the soap, previously dissolved in a little warm rain water or ordinary water with the addition of about 1 oz. soda. This mixture must be used the day it is made. Barium chloride may be used instead of the nicotine according to the formula :—2 to 4 lb. barium chloride, 4 lb. molasses and 20 gals. water. The barium chloride is dissolved in 2 gals. water, and the molasses is dissolved in an equal quantity ; these are mixed and water added up to 20 gals.

Autumn and winter treatments include the decortication of the stock, hot-water treatment and spraying with insecticides.

Désinfection des Végétaux par les Fumigations d'Acide Cyanhydrique. [Fumigation of Plants with Hydrocyanic Acid Gas.]—*Vie Agric. et Rur., Paris*, vii, no. 22, 2nd June 1917, pp. 399–400.

Insecticide fumigation of imported plants, together with inspection at the frontier, should serve to protect a territory from the introduction

of pests. The use of hydrocyanic acid gas must not be blindly relied on, as some pests, such as *Aulacaspis pentagona*, are not killed by a fumigation of $\frac{1}{3}$ oz. of potassium cyanide per forty cubic feet for 45 minutes to an hour, in spite of the fact that this is injurious to most plants.

The gas is best prepared by adding 1 part of pure (98 per cent.) potassium cyanide to 3 parts of water, to which 1 part of sulphuric acid of 66° Bé. has previously been added; this sequence in mixing should be strictly adhered to.

Baldensperger (J.). **Des Alpes aux Pyrénées.** [From the Alps to the Pyrenees.]—*L'Apiculteur, Paris,* lxi, nos. 3 & 4, March-April 1917, pp. 42–46.

In the course of a long journey during which bee diseases were thoroughly investigated, the author encountered the following bacilli: *Streptococcus apis,* causing the disease popularly known as sour-brood or pickled brood; *Bacillus alvei,* also known as *B. pluton,* causing European foul-brood, and *Bacillus larvae,* causing American foul-brood. *Streptococcus apis* was found very rarely; the disease is not very contagious and is easily cured with antiseptic treatment. *B. alvei* occurs much more frequently, particularly in the Alpine districts; the disease is contagious, but is curable. Disinfectants are sometimes successful, but a better plan is to pick out the diseased larvae with the point of a knife, or cut out the section containing the bacilli. *B. larvae* causes a liquid formation and therefore spreads readily throughout the hive. This disease is widely distributed and the only known remedy is to cut out and destroy all parts of the apiary attacked.

Degrully (L.). **Notes on Sprays for Vine Moths.**—*Progrès Agric. Vitic., Montpellier,* xxxiv, nos. 14, 17, 19; 8th April, 29th April, 13th May 1917, pp. 322–325, 394–395, 437–439. [Received 8th June 1917.]

The usual formulae for copper solutions are given. The lime recommended for Bordeaux mixtures is fat lime in lumps. The use of arsenical solutions against *Clysia ambiguella* is discussed, and the method of preparation of arsenate of lead and copper-arsenical solutions described.

Ravaz (L.). **Observations sur les Bouillies cupriques. Titrage de la Chaux.** [Observations on Copper Solutions. Titration of the Lime.]—*Progrès Agric. Vitic., Montpellier,* xxxiv, no. 15, 15th April 1917, pp. 341–342. [Received 8th June 1917.]

This paper describes the method of determining the weight of ordinary lime necessary to neutralise a given quantity of sulphate of copper. Following the formulae given, an acid, neutral, or alkaline solution in any degree can be obtained.

Mutelet (C. F.). **L'Arséniate de Plomb en Viticulture.** [Lead Arsenate in Vine-growing.] — *Rev. Viticulture, Paris,* xlvi, no. 1188, 5th April 1917, pp. 215–217. [Received 8th June 1917.]

The question of the period during which the spraying of vines with poisonous solutions, especially lead arsenate, may with safety be carried

out, has been made the subject of laboratory experiments. Analyses of the products of a vine which had been treated with a solution containing copper sulphate, sodium arsenate and lead arsenate up to the time that the grapes were one-third of their normal size, gave the following results :—the best wine showed infinitesimal traces of arsenic, but none of copper and lead ; the cloudy wine (vin de lie) yielded 5 mgm. per hectolitre of arsenic, a slight trace of copper, but none of lead ; the sour wine showed infinitesimal traces of arsenic, but none of lead or copper. On the other hand the lees yielded 500 mgm. per kilo. of lead, 10 mgm. per kilo. of arsenic and traces of copper, and the pressing (marc) gave 200 mgm. per kilo. of lead, 0·1 mgm. per kilo. of arsenic and traces of copper, and therefore could not be used as food for cattle. The conclusion is arrived at that arsenical treatment may be prolonged until the formation of the grape without injury to the wine, provided that it be carefully decanted from the lees ; while, on the other hand, the consumption of such wine before the lees had finally settled would be attended by a certain amount of danger.

Sarcos (O.). **L'Emploi des Emulsions Arsenicales, en Hiver.** [The Use of Arsenical Emulsions in Winter.]—*Rev. Viticulture, Paris,* xlvi, no. 1189, 12th April 1917, pp. 229–233. [Received 8th June 1917.]

The author urges that the use of soluble salts of arsenic for spraying vine-stocks in winter should be permitted by law, because an emulsion of soluble arsenical salts is a much better insecticide for the control of the larvae of *Sparganothis pilleriana* and *Clysia ambiguella* than lead arsenate, the use of which is permitted by an order of the Minister of Agriculture dated 15th September 1916. Fungus disease is also easily controlled by the use of soluble arsenites. The cost of spraying during winter is less than when the foliage is out, and the risk attending the use of a poison is then at its minimum. France is the only country in which the use of certain arsenical salts is forbidden, their use being authorised in England, Austria, Belgium, Greece, Holland, Portugal, and Sweden, while no regulation whatever exists in Germany, Denmark, Spain, Hungary, Italy, Russia and the United States.

Failing such legal permission, the only method of control would be the hot-water treatment, which is practically impossible under present conditions, owing to the scarcity of fuel.

Lambert (F.). **La Scorsonère dans l'Alimentation du Ver à Soie du Murier.** [*Scorzonera* as a Food of Mulberry Silkworms.]—*Rev. Viticulture, Paris,* xlvi, no. 1189, 12th April 1917, pp. 233–238. [Received 8th June 1917.]

During the past hundred years attempts have been made from time to time in France, Italy and Germany to rear the mulberry silkworm (*Bombyx mori,* L.) on the leaves of cheap and quickly-growing plants such as lettuce, wild chicory, *Scorzonera,* and nettles. It has been found that mulberry silkworms at first refuse to touch the leaves of *Scorzonera,* but later will eat them under the influence of hunger, though these individuals usually die without forming any silk. The mortality among the silkworms so fed is always very high, the

percentage of those forming cocoons very small, and the weight of silk produced only about half that from individuals fed on mulberries. In countries where the climate is not adapted to the cultivation of the mulberry, it might be advisable to attempt to produce a strain of silkworms adapted to feeding on *Scorzonera*; but in countries such as France and Italy, where the mulberry thrives, this would not be worth while.

FEYTAUD (J.). **Note sur les Vers gris.** [Note on the Caterpillars of *Feltia exclamationis.*]—*Rev. Viticulture, Paris,* xlvi, no. 1190, 19th April 1917, pp. 247–248. [Received 8th June 1917.]

The larvae of the Noctuid moth, *Feltia exclamationis,* destroy cereals, vegetables, beet-root, tobacco, weeds, and in the spring, when the ploughing has deprived them of the last-named, they attack and destroy the young vine-shoots. They are naturally controlled in the larval stage by moles, shrews, hedgehogs, Carabid beetles, a wasp (*Ammophila* sp.), and by parasitic Hymenoptera and Diptera, and in the adult stage by bats. Artificial means of control include spraying with Bordeaux mixture, or with nicotine and arsenical solutions; leaving trap-strips of weed-covered soil untilled and unploughed; hand-picking at night with lanterns; light-traps and molasses bait-traps; placing handfuls of weeds at the roots of the vines as traps; cutting of trap-trenches; and by lightly passing the finger through the surface soil at the foot of the vines, where the caterpillars lie hidden during the day-time.

(P. L.). **Cochenilles de la Vigne en Hongrie.** [Vine Coccids in Hungary.]—*Rev. Viticulture, Paris,* xlvi, no. 1191, 26th April 1917, p. 270. [Received 8th June 1917.]

The vine is cultivated in Hungary on the sandy plains, where it is free from *Phylloxera,* and also in clay soils suited to American vine-stocks. In the same soils *Robinia pseudacacia* also occurs and this is the food-plant of the Coccid, *Eulecanium robiniarum,* which spreads to the vines. The vine in Hungary is also liable to occasional infestation by *Pseudococcus citri, Pulvinaria betulae* attacking the old wood of trellis vines, and *Eulecanium persicae.* These scales are controlled by close pruning and by crushing the insects and their eggs.

GODARD (A.). **Les Insectes Carnivores et la Vigne.** [Predaceous Insects and the Vine.]—*Rev. Viticulture, Paris,* xlvi, no. 1192, 3rd May 1917, pp. 280–282.

The author pleads for the protection of birds rather than for the introduction and propagation of insects, as the natural means of controlling insect pests. An immense number of very harmful insects entirely escape the attacks of other invertebrates, while insects useful in controlling others may themselves cause damage, *e.g.,* earwigs and wasps that destroy other insects, but also damage fruit. Outbreaks of pests in agriculture always coincide with the disappearance of birds, and this is more felt in agriculture and viticulture than in forestry, woodland birds being less liable to destruction. A bird should not be condemned because of the damage done by it to a single

crop, as in the case of the starling, which damages vines far more than it protects them from insects, but is beneficial in fields and woods, though not in the vineyard.

FEYTAUD (J.). **Notes pratiques pour la Lutte contre Altise, Pyrale, Cochylis, Eudémis.** [Practical notes for the Control of *Haltica ampelophaga, Sparganothis pilleriana, Clysia ambiguella* and *Polychrosis botrana.*]—*Rev. Viticulture, Paris,* **xlvi**, no. 1193, 10th May 1917, pp. 299–303.

This paper gives brief notes for the control of these vine pests [see this *Review*, Ser. A, v, p. 339].

IVASHKEVITCH (B. A.). **Очеркъ лѣсовъ Восточной Горной Маньчжуріи.** [A Sketch of the Forests of the Mountains of Eastern Manchuria.] — **«Извѣстія Императорскаго Лѣсного Института.»** [*Memoirs of the Imperial Forestry Institute*], *Petrograd,* 1916, vol. xxx, pp. 163–232. [Received 30th June 1917.]

It is stated that Scolytids do great damage to spruce trees in Manchuria and that the increase of these beetles is favoured by the fact that the forests are full of fallen trees.

PUKHOV (B.). **Отравленныя приманки въ борьбѣ съ сѣверными кобылками въ Оренбургской губерніи.** [Poisoned Baits in the Campaign against northern Grasshoppers in the Govt. of Orenburg.] — **«Земледѣльческая Газета.»** [*Agricultural Gazette*], *Petrograd,* nos. 15–16 (181-182) & 17 (183), 5th & 12th May 1917, pp. 291–292 & 319–320.

This paper gives a fuller account of the author's use of poisoned baits, against grasshoppers [see this *Review*, Series A, v, pp. 196]. In some experiments with balls of bran, moistened in water and some aromatic substance, it was found that *Gomphocerus sibiricus* and other northern species are able to differentiate between odours. The smell of mint added to the bait increases its attractiveness, while burdock-oil and stale molasses decrease it. The odour of wet bran is itself very attractive and the grasshoppers will devour it even after it has become dry. The fact that this species does not collect in large swarms and does not travel long distances, greatly favours the application of this remedy.

BOGDANOV (G.) & UPENIECK (N.). **Докладъ объ организаціи борьбы съ вредителями и болѣзнями садовъ Батумской области въ 1916 г.** [Report on the Organisation of the Control of Pests and Diseases of Orchards in the Province of Batum in 1916.] — **« Русскіе Субтропики.»** [*Russian Subtropics*], *Batum,* no. 11–12, 1916, pp. 21–25. [Received 18th June 1917.]

This is a paper read at the first meeting of the Commission for the control of pests and diseases of orchards in the province of Batum. The report suggests limiting the operations of the Commission for the present to the coastal regions of the Province, where there are some 900 orchards.

UPENIECK (N.). **Опытъ организаціи отряда рабочихъ по борьбѣ съ вредителями цитрусовъ въ 1915 г.** [An Experiment in organising Gangs of Workmen for the Control of Pests of Citrus Trees in 1915.—**«Русскіе Субтропики.»** [*Russian Subtropics*], *Batum*, no. 11–12, 1916, pp. 29–72. [Received 18th June 1917.]

This paper describes fully the work carried out by a sub-committee of the Batum Agricultural Society entrusted with the conduct of the campaign against pests of citrus trees in the spring of 1915. A special gang of workmen was organised by the owners of the orchards in the locality at their own expense, the instructor of the Society being responsible for the general supervision of the work, which consisted of thinning the crowns of the trees and spraying with various insecticides. Over 30,000 trees were sprayed during the summer, at a cost of about £80. The principal insecticides used were carbolic emulsion, Scalecide, tobacco-lye emulsion, kerosene-carbolic emulsion and lime-sulphur.

Carbolic emulsion was prepared to contain from 1·6 to 2 per cent. of carbolic acid and from 1·5 to 2 per cent. of soft soap ; in some cases scorching of the fruit occurred, owing to the variable quality of crude carbolic acid available ; its application therefore requires great caution, especially in summer.

Kerosene emulsion contained 5% kerosene, and from ·5 to 1·3% soft soap ; it requires constant stirring, otherwise the kerosene rises to the surface ; it spreads easily over the tree and penetrates into all the cracks of the bark, but flows down the leaves and trunk, which may result in injury to the roots.

Carbolic-kerosene emulsion was composed of 5 per cent. kerosene, 1·7 per cent. soft soap and from 1·5 to 2 per cent. carbolic acid ; the last-named being added to the mixture of kerosene and soap ; this compound is more homogeneous, being lighter than carbolic emulsion, but heavier and less volatile than kerosene and is very stable, keeping for a long time. This emulsion, with from 0·88 to 1·66% hemp oil added, as recommended by Prof. Cholodkovsky, is more effective against scale-insects.

Scalecide, which is a ready-made product, was used at a strength of 10% in summer and 20% in winter and is, when fresh, very effective and harmless to the plants, its only disadvantage being its high price.

Tobacco-lye emulsion is composed of 1·66 to 3·33% tobacco extract and 1·66% soft soap in 100 parts of the liquid prepared by boiling dry wood-ashes in three times their volume of water for about one hour. This liquid should be tested before use for scorching and further diluted, if necessary ; it requires constant stirring and careful preparation to avoid choking the nozzle.

Lime-sulphur, when used in summer, contained 2% flowers of sulphur and 3% quick lime ; for winter use the proportion was 3% sulphur and 4·6% lime.

Soda-naphtha emulsion (Woburn mixture) was prepared either of 3·33% naphtha or kerosene, 0·88% soft soap and 2·1% caustic soda, or of 5% naphtha or kerosene, 0·83% soft soap, 7·43% carbonate of soda and 2·03% quick lime ; the last mixture is very unstable and requires constant stirring.

Tobacco extract emulsion consisted of 2·66% tobacco extract and 0·83% soft soap.

Naphtha residue (Mazut) emulsion, containing 6·66% of naphtha and 0·2% soft soap, proved very effective and resulted in the destruction of 90 per cent. of scale-insects, and is also quite harmless to the plants. Even a 5% solution of lysol was ineffective against scale-insects, but 10% carbolineum destroyed some 90% of a species of *Ceroplastes* in winter.

Most of the pests of citrus trees have not yet been finally identified. The most common pest present in all nurseries and orchards are mites of the genus *Tetranychus*; they chiefly attack *Citrus trifoliata*, but all other varieties also suffer. All the above-named insecticides, even in weak solutions, were effective against mites, but the eggs proved more difficult to destroy, the most effective remedies against them being lime-sulphur and Scalecide. COCCIDAE were numerous, including:—*Coccus* (*Lecanium*) *hesperidum*, against the young larvae of which all the above insecticides proved effective, though the older ones were affected only by strong lye, oil or lime-sulphur solutions; against *Chrysomphalus* (*Aspidiotus*) *aurantii*, Scalecide gave the best results, though even this was not entirely effective. Against *Mytilaspis* sp., one of the most injurious species, Scalecide, lime-sulphur, soda-naphtha and tobacco-lye proved of some value, though several sprayings are necessary and the trunk and infested branches must also be smeared with a mixture of 2–3 parts by volume of 3 per cent. milk of lime and one part of carbolineum; with 1 lb. carbolic and 1 lb. soft soap in 2–3 gallons of water; with the mixture recommended by Trabut, composed of 35% lime, 20% caustic soda and 45% flowers of sulphur; or with that used by F. F. Penkov consisting of 2 lb. of lime, 4 lb. of carbolineum and 8 lb. of lye ashes. Against *Ceroplastes* sp., which attacks tea as well as citrus, none of the insecticides had any effect on the adults, though the larvae were most affected by Scalecide. Three other species of unidentified Coccids occurred in this locality, one of which was also found on tea.

Aphids on citrus can be effectively controlled with kerosene and carbolic emulsion, soft soap, or a decoction of quassia containing 1·3% of soft soap.

BALTRUK (N.). **Борьба съ кровяной тлей на Черноморскомъ побережьи Кавказа.** [The Control of the Woolly Aphis on the Black-Sea Coast of Caucasia.]—**«Русскіе Субтропики.»** [*Russian Subtropics*], *Batum*, no. 11–12, 1916, pp. 117–119. [Received 18th June 1917.]

The following notes on the control of the woolly aphis [*Eriosoma lanigerum*] are given. In autumn, after the fall of the leaves, 8–10 lb. of freshly slaked lime is dug into the soil round each tree; this should be done every 3–5 years, the trunks being washed with lime annually. In February or March, before the buds have unfolded, the trees are further treated with kerosene emulsion and lye or with milk of lime and iron sulphate. Kerosene emulsion with lye is prepared by boiling 3 lb. of soft soap in 4 pints of water till the soap has dissolved; 15 pints of kerosene are then added and the whole is added to the lye, prepared separately by boiling about 3 gallons of dry ashes in 4 or 5 gallons of water and diluting it with 35 gallons of water; another 8 gallons of water are added to the mixture and it must be used the

same day and followed in 1–2 hours by spraying with milk of lime and iron sulphate. The latter is prepared by dissolving 3 lb. of sulphate in about 3 gallons of water, and 10 lb. of quick lime in 8–9 gallons of water, and pouring the two solutions, first the sulphate and then the lime, into a vessel containing about 40 gallons of water. The lime solution dries quickly and forms a crust, which prevents the evaporation of the kerosene emulsion.

LIZER (C.). **Une nouvelle Coccidocécidie de l'Argentine et Description du Cécidozoaire qui la produit** (*Mesolecanium deltae*, **n. sp.**) [A new Gall from Argentina and a Description of the Coccid producing it, *Mesolecanium deltae*, sp. n.]—*Broteria, Braga*, xv, no. 2, 1st June 1917, pp. 103–107, 5 figs.

A description is given of *Mesolecanium deltae*, sp. n., which produces galls on citrus leaves in the neighbourhood of Buenos Aires. This scale is parasitised by an unidentified Hymenopteron.

CORTI (A.). **Specie nuove di Eriofidi cecidiogeni del Territorio Argentino.** [New Species of gall-forming Eriophyids from Argentina.] *Broteria, Braga*, xv, no. 2, 1st June 1917, pp. 108–112, 3 figs.

The following Argentine gall-forming mites are described :—*Eriophyes baccharidis*, sp. n., on *Baccharis salicifolia* ; *E. condaliae*, sp. n., on *Condalia lineata* ; and *Phyllocoptes amaranti* on *Amarantus muricatus.*

CECCONI (G.). **Manuale di Entomologia Forestale**. [Manual of Forest Entomology.]—*Florence*, Fasc. 5, 64 pp., 85 figs.

The fifth part of this book [see this *Review*, A, iv, p. 492] covering pp. 257 to 320 continues an account of the Coleopterous pests of forests.

GREEN (E. C.). **Instrucções contra a Lagarta rosea do Algodão.** [The Control of *Pectinophora gossypiella*, Saunders.]—*A Lavoura, Rio de Janeiro*, **xxi**, no. 1, January 1917, p. 25. [Received 8th June 1917.]

The pink boll worm, *Pectinophora* (*Gelechia*) *gossypiella*, Saund., has recently been found in abundance in the north-east of Brazil [see this *Review*, Ser. A. v. p. 288]. Disinfection of the seed with carbon bisulphide is the control advised.

Extincção da Saúva. [Destruction of the Leaf-cutting Ant.]—*A Lavoura, Rio de Janeiro*, **xxi**, no. 1, January 1917, pp. 26–27. [Received 8th June 1917.]

The Commission appointed by the National Society of Agriculture have issued their report on the Werneck Ant Exterminator, an apparatus similar to one already described [see this *Review*, A, v., p. 231] and like it intended for use against the ant injurious to agriculture in Brazil [*Atta sexdens*, L.]. It is of stouter build, but can be carried

by one man. The powerful blower, which is placed on a stand for use, proved capable of driving the gases to a considerable distance underground, the ants being destroyed within a radius of about 130 yards. The gases are produced by burning sulphur in a closed furnace, whence they are lead to the ant-hole by a metal pipe. The high toxicity of the gases in this case is held to be due to CSO of which 1 per thousand was present on analysis, this proportion being sufficient to kill the ants in about 4 minutes. A large-sized nest can be treated in 18 minutes with this apparatus.

Arrow (G. J.). **The Khapra Beetle (*Trogoderma khapra*, sp. n.), an Indian Grain Pest.**—*Ann. Mag. Nat. Hist., London*, xix, no. **114**, June 1917, pp. 481–482.

Trogoderma khapra, sp. n., has previously been figured and recorded under the name, *Attagenus undulatus*, Motch. [see this *Review*, v, 1917, p. 126]. It is found in enormous profusion in cargoes of wheat from Karachi and Bombay, but has not occurred in grain imported from countries other than India, nor has it been known to perpetuate itself in Europe.

Deakin (R. H.). **Insect Pests of Agriculture in British East Africa.**—*Ann. App. Biol., London*, 1916, ii, no. **4**, pp. 241–244. [Received 28th July 1917].

During 1914 large bands of the locust, *Schistocerca peregrina*, in both the adult and larval stages, appeared throughout the Protectorate, causing, however, only minor injuries to coffee and maize crops. *Antestia variegata* (African coffee bug) is the most serious pest attacking coffee, but its numbers are periodically lessened by a Chalcid which parasitises more than 50 per cent. of its eggs. Other pests attacking coffee are the scale-insects, *Coccus* (*Lecanium*) *africanus* and *Saissetia* (*Lecanium*) *nigra*, the latter being heavily parasitised, and the cutworm, *Euxoa segetum*, which can be controlled by clean cultivation and the use of poisoned bait. The insects recorded on citrus plants include :—*Argyroploce leucotreta*, the caterpillars of which attack ripe oranges ; the Australian bug, *Icerya purchasi*, which however cannot be regarded as a pest ; small Halticid beetles which suddenly appear in swarms and seriously injure the young leaves ; *Papilio mackinoni* ; and a small mite, not yet identified. *Eriosoma lanigerum* has been recorded on apples, but winged individuals have not yet been observed. The leaves of quince trees have been seriously damaged by the larvae of the moth, *Orgyia vetusta*, which is naturally controlled by an Ichneumonid. The larvae of the moth, *Duomitus capensis*, kill the branches of a native tree (*Cassia didymobotrya*) by boring through them. The black wattle (*Acacia decurrens*) is attacked by what is believed to be the larva of a Buprestid, but the adult has not yet been reared. The best means of control is to fell and strip the bark off all trees that are attacked, and to remove all that are in poor condition. This tree is also injured by Jassid and Capsid bugs.

Lees (A. H.). **Winter Cover Washes (Conclusion).**—*Ann. App. Biol., London,* ii, no. 4, April 1916, pp. 245–250, 2 tables. [Received 28th July 1917.]

During 1914–15, further experiments were made by the author to find a mixture for winter cover-washes that could be made cheaply and easily [see this *Review*, iii, p. 286]. Trials with starch, resin and casein proved that they rendered the coating so soft that it was easily washed off by the rain, and the same was the case when macerated paper was incorporated as a binding substance. The cost of boiled linseed oil rendered it unsuitable, though it might otherwise have given good results. Mixtures of lime and glue proved failures owing to the precipitation of the glue by the alkali, but further experiments showed that cold well-slaked milk of lime added to a cold solution of glue gave no such precipitate for several hours, but on the contrary a firm thin coating. A mixture of 30 parts lime, 2 parts glue and 100 parts water gave a thick firm coat which weathered somewhat on exposure to rain. The plan was tried of warming the lime so as to cause the glue gradually to become insoluble as it dried on the tree, but any delay, such as that due to choked nozzles, rendered the glue insoluble before it reached the tree, thus lessening the covering power of the mixture. The desired effect was however obtained by the addition of potassium bichromate, which on exposure to light causes glue to become insoluble. The best working formula therefore is:—lime 30 lb., glue 2 lb., potassium bichromate $\frac{3}{8}$ oz., water 10 gals. To make it, 30 lb. of lime is put in a tub and 6 gals. of water poured over it. When the lime begins to boil, 2 more gals. of water are gradually added. Then 2 lb. glue is put into a pail with 1 gal. of cold water and occasionally stirred. When the lime has slaked and become cold (after about 6-12 hours) one gallon of hot water is added to dissolve the glue and this is added to the lime, well stirred and filtered through a 16 mesh to the inch sieve into the spraying machine, and the potassium bichromate, previously dissolved in a little water, is added and the whole stirred. The approximate cost of this mixture works out at $1\frac{1}{4}d.$ a gallon.

Lees (A. H.). **Some Observations on the Egg of** *Psylla mali.*—*Ann. App. Biol., London,* ii, no. 4, April 1916, pp. 251–257, 8 figs. [Received 28th July 1917.]

It has been known for some years that the egg of *Psylla mali* (apple-sucker) hatches at slightly different times on different varieties of apple trees, the correspondence between the dates of bud bursting and egg hatching being so close as to suggest some intimate relation between the egg and the plant. Theobald has suggested that the heat generated by the flow of sap to the opening buds regulated the hatching of the eggs. A microscopical examination of the eggs, which are laid chiefly at the base of the fruit-spurs, reveals the fact that the two outer membranes are produced at the posterior end into a hollow process that is inserted in the bark. At first it was thought possible that the mouth-parts were contained in this process and that there was a physiological connection between the egg and the tree; but this is not the case, the mouth-parts lying at the opposite end of the egg. Another view, that the sudden increase of pressure of the

sap near the tube might set up an equally sudden increase of pressure inside the egg, sufficient to induce hatching, is suggested as a possible hypothesis, though more evidence on this point is necessary.

Edwards (F. W.) & Williams (C. B.). *Sciara tritici,* **Coq., a Fly injurious to Seedlings.**—*Ann. App. Biol., London,* ii, no. 4, April 1916, pp. 258–262. [Received 28th July 1917.]

Isolated cases of damage by the larvae of a species of *Sciara* were reported from Surrey in 1911, the plants attacked being *Primula* seedlings, and from Yorkshire in 1915, in which case young orchids suffered. The species concerned, which has not been previously recorded in Great Britain or even in Europe, proves to be *Sciara tritici,* known in N. America since 1895 as a severe pest of wheat and orchard seedlings, of which it destroys the rootlets and young stems just above and below the soil level. The adults on the wing can be killed by regular nicotine fumigations, as they emerge at all hours of the day, but the larvae and pupae seem to be immune to this treatment. The original habitat of this fly is unknown, but its presence in greenhouses is probably due to introduction in *Osmunda* fibre or *Sphagnum* moss used in the cultivation of orchids.

Rennie (J.). **On the Biology and Economic Significance of** *Tipula paludosa.* **Part I. Mating and Oviposition.**—*Ann. App. Biol., London,* ii, no. 4, April 1916, pp. 235–240, 1 plate. [Received 28th July 1917.]

During the summer of 1913 and 1914, the mating and oviposition of the crane-fly, *Tipula paludosa,* was studied both in the field and the laboratory, where the larvae were kept in cages. The pupae were transferred to small vessels of the size of flower-pots containing soi and small pieces of turf, and covered with lamp-chimneys closed at the top with pieces of cardboard. Hatching takes place at the end of June or beginning of July, the earliest recorded date on which mating was observed being 20th June. The results, which were always consistent, showed that recently hatched insects pair most readily, and, given the opportunity, do so a number of times. Oviposition takes place soon after mating, though the presence of herbage as a stimulus is necessary, no oviposition occurring on cottonwool, even if placed above a layer of soil, nor on bare soil. Though these flies usually oviposit among grasses, they may do so among standing corn. About half a dozen eggs or less may be deposited at the same spot. The eggs in a newly hatched female may be seen through the skin, but these do not represent the whole number, there being a second batch which matures later. The length of life of individual crane-flies has not so far been determined. The flies kept in captivity were not fed, but had access to growing grasses and to soil, both of which were watered.

Rennie (J.). **On the Biology and Economic Significance of** *Tipula paludosa.* **Part II. Hatching, Growth and Habits of the Larva.**—*Ann. App. Biol., London,* iii, nos. 2 & 3, January 1917, pp. 116–137, 3 plates.

Tipula paludosa is the commonest species of crane-fly occurring on grasses and corn in the north-east of Scotland. Other species less

frequently found are *T. oleracea*, *T. varipennis*, *T. gigantea*, *T. lutescens* and *Pedicia rivosa*, L. The adults of *T. paludosa* emerge during June to September. The larvae hatch in about 14 days and immediately begin to feed. The larval stage varies in length, but probably occupies about nine months, larvae being found in the soil all the year round. In England there are apparently two generations, while in Scotland, probably owing to the difference in climate, there appears to be only one. Damage to crops may be negligible even though the larvae of *T. paludosa* are present in the soil, and experiments have shown that these larvae can exist in soil and complete their development independently of the presence of a growing crop in the ground.

Migration is brought about by scarcity of food in spring, but whether the larvae migrate normally in appreciable numbers in the search for food is as yet uncertain. The opinion has been expressed that the larvae are not migratory [see this *Review*, Ser. A, ii, p. 606], but the author is convinced that this theory is erroneous. The circumstances determining a destructive attack on a crop seem to be a combination of conditions favourable for the survival of large numbers of young, which in their early days are very susceptible to drought, excessive sunlight, etc., unfavourable conditions for competitors, a ready supply of food and the absence or scarcity of natural enemies. Oats are destroyed only when attacked in the early days of their growth; after the adventitious root system is established, the plants suffer very little damage. Any conditions which tend to extend the period of germination therefore render the crops more liable to attack. Early sowing is for this reason attended by a certain amount of risk.

Experiments with insecticides were inconclusive in this connection. A change of seed has been found useful as a control; seed grown on the coast and sown inland has proved more resistant to the larvae than locally grown oats.

The subject of remedial measures will be dealt with in a subsequent paper.

Lees (A. H.). **Accessory Wetting Substances with Special Reference to Paraffin Emulsions.**—*Ann. App. Biol., London*, iii, no. 4, April 1917, pp. 141–149, 3 tables. [Received 9th June 1917.]

The wetting power of a fluid is increased by the addition of soft soap provided that there is no substance in the fluid which can precipitate it. Soap alone is however insufficient to cause the wetting of the woolly aphis [*Eriosoma lanigerum*] on apple trees, or of the American gooseberry mildew, while paraffin emulsions are liable to scorch the foliage. In published formulae of liquids containing both soap and paraffin, the proportion varies from 100 parts of paraffin to 1·2 parts of soap on the one hand, to 100 parts of paraffin to 240 parts of soap on the other. Solutions containing a very small proportion of soap ($\frac{1}{2}$ per cent.) de-emulsify on standing and are dangerous to use, while those with $1\frac{1}{2}$ per cent. soap and 20-25 per cent. paraffin are unsafe as they de-emulsify on being sprayed. Experiment has shown that the best mixture contains 2 per cent. soap, i.e., 20 lb. to 100 gals. water, and 2 per cent. paraffin, i.e., 2 gals. to 100 gals. water. The value of this solution lies not only in its own killing power, but in the fact that it acts as a carrier for other fungicidal or insecticidal

bodies, which alone would be ineffective. Liver of sulphur alone cannot control the American gooseberry mildew, but gives very good results with this emulsion, as does also a dilute solution of nicotine, which, alone, has no decided action on adult caterpillars and only kills *Byturus tomentosus* (raspberry beetle) with difficulty.

CHAPAIS (J. C.). **Quelques Notes sur le "Ver Limace du Poirier."** [Some Notes on the Cherry Sawfly.]—*Nat. Canad., Quebec,* xliii, no. 10, April 1917, pp. 153–156.

The cherry sawfly is described, the control measures recommended being the powdering of the leaves of infested trees with freshly slaked lime, and the use of arsenical insecticides.

EHRHORN (E. M.). **Pests intercepted in the Course of Inspection.**—*Rept. Div. Entom. for the Bien. Period ending 31st December 1916, Territory of Hawaii Board Agric. and Forestry, Honolulu,* 1917, pp. 97–101. [Received 11th June 1917.]

During 1915–16 the introduction of several serious pests from foreign countries was prevented by careful inspection. *Aleurodes citri* (citrus whitefly) was found several times on hothouse plants from Florida, and *Adoretus tenuimaculatus* (Japanese rose-beetle), *Anomala orientalis* and several closely allied species occurred in soil from the Far East. In the latter part of 1916 a large colony of the Argentine ant [*Iridomyrmex humilis*] was found in plants from California, in which State it has become widely distributed, causing much anxiety on account of the damage done to stored food. This report also contains a complete list of all the insects collected during the above period.

FULLAWAY (D. T.). **Report on Beneficial Insects.**—*Rept. Div. Entom. for the Bien. Period ending 31st December 1916, Territory of Hawaii Board Agric. and Forestry, Honolulu,* 1917, pp. 105–109. [Received 11th June 1917.

Opius fletcheri, Silv., was successfully introduced in 1916 to control *Dacus* (*Bactrocera*) *cucurbitae* (melon fly). In many places this pest is largely checked by predaceous Staphylinid beetles, and also by *Spalangia*, a common Chalcid parasite of the pupa. *Anagrus*, *Paranagrus*, *Ootetrastichus* and *Gonatopus*, four parasites of the eggs of the corn leaf-hopper, were introduced from Manila, and *Paranagrus* was propagated and established. The fruit-fly parasites, *Tetrastichus giffardianus*, *Diachasma fullawayi*, *D. tryoni*, *Dirhinus giffardi*, *Galesus silvestrii* and *Opius humilis*, were propagated and liberated. *Paraleptomastix abnormis*, which attacks several species of mealy-bugs, chiefly *Pseudococcus citri*, *P. sacchari*, and probably *P. bromeliae*, was introduced into California from Sicily, and from California into Hawaii in 1915. Parasites of the horn-fly [*Lyperosia*] that have been propagated and liberated include *Spalangia cameroni*, *S. philippinensis*, *Muscidifurax raptor* and *Pachycrepoideus dubius*.

Mayné (R.). **Rapport sur une Maladie des Bananiers au Mayumbe (Bas-Congo).** [Report on a Banana Plant Disease at Mayumbe (Lower-Congo).]—*Bull. Agric. Congo Belge, London*, vii, nos. 3–4, September-December 1916, pp. 236–239, 1 fig. [Received 11th June 1917.]

Cosmopolites sordidus, Germ. (banana weevil) seems to be of recent introduction in the lower Congo, serious damage by it having been reported only during the last 2 or 3 years. The larva bores into the root and base of the stem, attacking chiefly young plants and those in dry situations, and is most injurious in dry weather. In badly infested districts the natives have been compelled to substitute the cultivation of ground-nuts and maize for that of the banana. The only control lies in the destruction of infested plants, not, however, by burning, as the succulent nature of the stem renders this impracticable, but by cutting up and burying them at a depth of from 20 to 30 inches, the subsequent decomposition killing both larvae and adults.

Cotton Experiments 1916.—*Mississippi Agric. Expt. Sta., Mississippi*, Bull. no. 178, December 1916, 40 pp., 3 figs., 19 tables. [Received 11th June 1917.]

Anthonomus grandis (the cotton boll weevil) is the chief limiting factor in the production of cotton in Mississippi, where it has gradually spread and increased since 1907. No satisfactory method of control has yet been found, though many have been suggested and tried. Picking by hand during the early part of the season, or collecting the weevils by shaking the plants over a bag, which has a barrel hoop sewed in it to keep it open, are of no practical value on large plantations. Since cotton is the sole food-plant of this weevil, the cutting off of the food supply in autumn by destroying the cotton stalks would prevent many from hibernating. All dead timber and hollow trees that are the favourite hibernating places should be destroyed, and cotton should not be planted on areas adjacent to woods or forests. The early planting of early maturing varieties of cotton is an additional safe-guard.

Leiby (R. W.) & Sherman (F.). **Spraying Irish Potatoes.**—*Agric. Extension Service, Raleigh and W. Raleigh, N. Carolina*, Exten. Circ. no. 48, May 1917, 8 pp. [Received 12th June 1917.]

Leptinotarsa decemlineata (Colorado potato beetle) can be controlled by spraying with poisoned Bordeaux mixture every 10 or 15 days, according to the persistency of the beetles and the amount of rain, beginning when the plants are only 4-6 inches high. The recommended formula for Bordeaux mixture is :—Stone lime (rock lime or quick lime, unslaked) 4 lb., bluestone (copper sulphate or blue vitriol) 3 lb., lead arsenate, 3 lb. in the paste form or $1\frac{1}{2}$ lbs. of dry powder, water 50 U.S. gals. A simple dusting powder may be made by thoroughly mixing 1 lb. Paris green and 15 lb. dust lime.

Planters and a Bug Pest.—*African World, London*, 9th June 1917, p. 147.

Since the ravages of the variegated bug [*Antestia variegata*] constitute a most serious menace to the future of coffee planting in the

Uganda Protectorate, the Uganda Planters' Association are requesting the Government to appoint a competent entomologist to deal with the control of this pest.

Insect Pests in Barbados in 1915-16.—*Agric. News, Barbados,* xvi, no. 393. 19th May 1917, p. 154. [Received 14th June 1917.]

In Mauritius, *Phytalus smithi* (the brown hard-back), a serious pest of sugar-cane, has only just been kept in check by the combined action of planters and the Government in catching the beetles, for which large sums have been paid; its natural parasite, *Tiphia parallela,* has been imported from Barbados, but this wasp has only just begun to establish itself. In Barbados there are also some districts in which the pest occurs without its parasite. [See this *Review,* Ser. A, iii, p. 500.] *Diaprepes abbreviatus* (sugar-cane root borer) has been most injurious where no proper crop rotation is practised. Its control can be effected by the collection of adults and egg-masses, a regular rotation of crops, and the digging up of stumps in infested fields immediately after reaping the crop. *Diatraea saccharalis* (moth borer) has been a generally distributed pest, which can be effectively controlled only by a systematic collection of the egg-masses and preservation of the egg-parasites. Other sugar-cane pests noticed were *Pseudococcus calceolariae* and *P. sacchari.* Tomatoes were damaged by a cutworm, *Prodenia dolichos.*

Anstead (R. D.). **The Fluted Scale in Ceylon.**—*Planters' Chronicle, Bangalore,* xii, no. 20, 19th May 1917, pp. 251–252. [Received 15th June 1917.]

The presence in Ceylon of *Icerya purchasi* (fluted scale), a serious pest of acacia and citrus trees in California and Australia, is recorded. It was probably introduced in or about 1915 on acacias from Australia, and has attacked *Acacia decurrens, A. dealbata, Casuarina* and *Citrus.* It is partly controlled by Coccinellid beetles and a few insect parasites, as well as by a parasitic fungus during the monsoon season.

Dutt (H. L.). ***Agrotis* at Colgong and Ghogha in 1915-16.**—*Agric. Jl. Dept. Agric. Bihar and Orissa, Patna,* iv, October 1916, pp. 15–23, 1 plate. [Received 16th June 1917.]

The campaign against *Agrotis ypsilon* (greasy cutworm), which was begun in August and continued until January, consisted in hand-picking the caterpillars, 133,443 being destroyed, and in catching the moths by means of Andres-Maire traps, 56 of which accounted for 437,956 during that period. Heavy irrigation was found as effective as hand-picking against the caterpillars, and at the same time more economical, provided that plenty of water was close at hand. The season was marked by the peculiar absence of the Hymenopterous parasite in the Taurar area; but towards the end of it a Tachinid parasite was very common, though less effective owing to its numerical inferiority. In the Ekchari district the Hymenopteron was found to have attacked 75 per cent. of the caterpillars collected.

To Trap Orange Moths and Fruit Flies.—*Queensland Agric. Jl., Brisbane*, vii, part 4, April 1917, p. 172. [Received 16th June 1917.]

Several species of large sucking moths attack the fruit of citrus trees as soon as it shows signs of ripening. To prevent this, a good plan is to gather a few forward fruits and ripen them artificially. They should then be hung in conspicuous places in the orchard where, by their odour, they will attract both moths and fruit-flies. The latter will also oviposit in such fruits, so that the destruction of the fruits before the larvae are mature will prevent a second generation. An effective fruit-fly trap can be made by smearing some of the fruits with tanglefoot before hanging them in the orchard.

The Lantana Pest. A New Fly imported from Hawaii.—*Queensland Agric. Jl., Brisbane,* vii, part 4, April 1917, pp. 183–184. [Received 16th June 1917.]

The lantana plant, though useful for its soil-fertilising properties and for honey production, has become a veritable pest in parts of Queensland. As a control the lantana fly [*Agromyza* sp.] has been introduced from Hawaii, where it was established in 1902 [see this *Review*, Ser. A, iii, p. 757]. Both this fly and the lantana plant are natives of Mexico, and it has never been known to be associated injuriously with any other plant. It lays a single egg in the green lantana berry and prevents its development.

Wenholz (H.). **The Care of Seed Maize.**—*Agric. Gaz. N. S. W., Sydney*, xxviii, part 4, 2nd April 1917, pp. 229–243. [Received 19th June 1917.]

Many farmers in New South Wales have come to regard the keeping of maize seed as an impossibility, owing to the ravages of *Calandra oryzae*, L. (rice weevil) and *Sitotroga cerealella*, Oliv. (Angoumois grain moth). Of these, the weevil is by far the more destructive, as it can survive the winter in all stages, if not too severe, which is never the case on the North Coast. The eggs are laid on the tips of the cobs, if not covered by the husk, and the larvae eat into the grain and pupate there, the adults feeding inside the grain for 4 or 5 days and destroying the germ. The whole cycle takes 5 or 6 weeks, and there may be 4 or 5 broods before the cold weather sets in, this rendering the seed of early sown crops especially difficult to keep. *S. cerealella* also lays its eggs on the tips of the cobs, whether covered by the husk or not; though the larvae attack the grain, the germ is not affected.

The selection of a variety of maize with a tightly-fitting husk, and the practice of late sowing will materially lessen the damage caused by the weevil,and at harvest time the removal of the uppermost grains of all the seed-ears is a precaution worth taking against both pests. Since the moth works at a lower temperature than the weevil, in moth-infested districts the cobs should be dried as quickly as possible and stored in bins after fumigation. Early spring fumigation of the stored seed-grain should be carried out, and repeated, if necessary, every 3 weeks, if it is to be kept for late sowing.

The most effective fumigant is carbon bisulphide, especially if the fumigating bin is air-tight; the grain should be subsequently exposed to the air to get rid of the fumes. The amount to be used depends on the temperature; at 60°-70° F., 1 oz. (two large tablespoonfuls) is sufficient for 6 bushels of husked cobs, or 1 oz. to every 3 bushels of shelled grain. In large quantities 1 lb. of carbon bisulphide is required for 100 bushels of cobs. In fumigating empty spaces 1 lb. liquid is enough for 100 cubic feet. At lower temperatures the quantities should be increased by half, but at higher temperatures $\frac{1}{2}$-$\frac{3}{4}$ of the amount stated will suffice. As the fumes are heavier than air the liquid must be put in shallow vessels or on cotton waste on the top of the grain to be treated.

Hydrocyanic acid gas is a rapid and certain insecticide, but owing to its being highly poisonous, it can only be used in a specially constructed fumigator. Naphthaline scattered throughout the stored grain has proved a successful method of keeping seed maize, but if the grain is to be used for feeding stock, it must be thoroughly aerated to remove the odour. Other remedies are the exposure of the grain to the heat of the sun, preferably on a black tarpaulin, a temperature of 116° F. killing the weevils in 10 minutes; the whitening of the walls of the store with quicklime, and the placing of barrels full of it in the corners to absorb all moisture; coarse salt, kerosene and sulphur dioxide gas have been tried, but destroy the germinating power of the grain.

Green (W. J.), Selby (A. D.) & Gossard (H. A.). **Calendar for the Treatment of Plant Diseases and Insect Pests.**—*Ohio Agric. Expt. Sta., Wooster*, Bull. no. 309, January 1917, 31 pp. 3 figs. [Received 19th June 1917.]

This bulletin contains a spray calendar, a synopsis of seed and soil treatments, arranged alphabetically, and the formulae, methods of preparation and directions for use of numerous fungicides and insecticides.

Whitmarsh (R. D.). **The Green Soldier Bug,** *Nezara hilaris*, **Say.**—*Ohio Agric. Expt. Sta., Wooster*, Bull. no. 310, February 1917, 33 pp,, 16 figs., 7 tables. [Received 19th June 1917.]

This bulletin supplements a previous paper on *Nezara hilaris* (green soldier bug) [see this *Review*, Ser. A, ii, p. 704]. Further observations continued during the years 1911–1916 lead to the conclusion that climate is one of the most important factors in the natural control of this insect, a winter with sudden, wide variations of temperature being more unfavourable than a very cold season in which the temperature is uniformly low. A Hymenopteron, *Trissolcus* sp., probably *T. euschisti*, Ashm., which is an egg-parasite, also exerts a great influence in holding this pest in check.

Gossard (H. A.). **Distribution of the Ohio Broods of Periodical Cicada with Reference to Soil.**—*Ohio Agric. Expt. Sta., Wooster*, Bull. no. 311, March 1917, 22 pp., 14 figs. [Received 19th June 1917.]

A most striking coincidence has been noticed between the maps, prepared by the author, showing the areas occupied by the most

notable Ohio broods of the periodical cicada [*Tibicen septemdecim*], and the soil maps of Ohio published by the U.S. Bureau of Soils. From this the inference has been drawn that the nature of the soil must be a potent factor in determining the limits of several Ohio broods, since the western limiting line of the 1897 broods exactly corresponds with the line dividing the western dolomitic limestones from the eastern sandstones and shales. The question of drainage and soil temperature operating at a critical stage such as pupation may perhaps have some bearing on the problem, as the underground drainage in the east is much poorer than in the west, resulting in a lower spring temperature of the soil, though exceptional spots occur east and west of the line without affecting the distribution of the cicada. Another possible factor may be the presence of lime in the soil, affecting chitin formation, directly or indirectly.

As to the theories of brood formation, the suggestion has been made that local glacial conditions may have retarded the development of the species for different periods in different localities; another view is, that new broods have been made by splitting off from the main broods, and another, that environment has caused the appearance locally of a new brood earlier or later than the original one, which might be left to hold the territory alone or become the predominant one should some accident in the course of years happen to the parent brood in that locality. Such conditions as variation in climatic conditions, geological changes, or changed topographical conditions of the country, including the character of the vegetation, might conceivably result in the acceleration or retardation of entire broods of this insect.

KING (J. L.). **The Peach Tree Borer.**—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster*, ii, no. 1, January 1917, pp. 23–28, 2 figs. [Received 19th June 1917.]

Aegeria (*Sanninoidea*) *exitiosa*, Say (peach-tree borer) is the most important insect enemy of the peach east of the Rocky Mountains. The moths attain their maximum prevalence about mid-August, an average of 400 fertile eggs being deposited by each female. The larvae bore into the base of the trunk by way of the crevices in the bark, and become established below the level of the soil. A single larva may cause the death of a small tree by girdling the base of the stem, thus cutting off the sap supply. In bad cases as many as 30 larvae may inhabit a single tree. After numerous experiments with insecticides and mechanical protectors, the only efficacious method of control seems to be that of "worming" or cutting the larvae out of their burrows by means of a sharp knife. This process, which requires great care and skill, should be performed in the autumn during October or November, and again early in the summer, between the first and 10th June.

The soil should be hoed away from the base of the tree to a depth of 6 inches, so that the larvae may be located by the exudation of gum and the presence of sawdust. After the larvae have been removed and killed, the soil should be replaced in a mound 6 to 8 inches high round the trunk as a protection from fresh infestation, and left until the second operation in October, when the mounds should be removed so that the trees may harden for the winter.

Spraying, under pressure, with a mixture of commercial lime-sulphur solution, 1 U.S. gal. to 8 U.S. gals. water, with 1 lb. lead arsenate paste (or ½ lb. powdered lead arsenate) and a little extra lime to make a thin coating, though not a complete remedy in itself, reduces the number of borers, and thus greatly lessens the laborious task of worming.

Brood of 17-year Locusts to appear next Spring.—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster*, ii, no. 2, February 1917, p. 66. [Received 19th June 1917.]

A brood of the periodical cicada [*Tibicen septemdecim*] was expected to appear in the eastern part of Ohio during the spring of 1917, and a large brood is expected over the western part of the State in 1919. In the latter district fruit trees should not be planted extensively in the spring of 1918. Young trees should have the trunks and large limbs wrapped with paper to prevent oviposition, and the upper limbs should then be enclosed in mosquito netting as a complete protection, or sprayed with Bordeaux mixture or lime-sulphur wash as a partial protection; these measures are much more effective than attempts to kill the insects themselves.

GOSSARD (H. A.). **Cutworms. Their Habits, Characteristics and Means of Control.**—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster*, ii, no. 3, March 1917, pp. 85–90. [Received 19th June 1917.]

The most common and destructive cutworms in Ohio are *Sidemia* (*Hadena*) *devastatrix* (glassy cutworm), *Parastichtis* (*H.*) *arctica* (yellow-headed cutworm), *Agrotis ypsilon* (greasy cutworm), *Lycophotia* (*Peridroma*) *margaritosa* (variegated cutworm), *Agrotis* (*Noctua*) *c-nigrum* (spotted cutworm), *Feltia subgothica* (dingy cutworm), *F. aculifera* (western striped cutworm), *F. gladiaria* (clay-backed cutworm), *Nephelodes emmedonia* (*minians*) (bronze cutworm), *Agrotis unicolor* (*Noctua clandestina*) (W-marked cutworm), *Feltia annexa* (granulated cutworm), *Euxoa messoria* (dark-sided cutworm), *E. ochrogaster* (common striped cutworm), and *Polia* (*Mamestra*) *renigera* (bristly cutworm).

Their natural enemies are nearly all ground-frequenting birds, such as robins, blackbirds, bluebirds, crows and domestic poultry, which all feed greedily on them, while toads, skunks and shrews devour them whenever possible. Their commonest and most effective enemies are parasitic flesh-flies, which lay their eggs just behind the head of the cutworm. They are also preyed upon by ground-beetles and tiger beetles and their larvae and by digger wasps, and other insects.

Since the eggs are laid among rank-growing, succulent herbage, the best method for preventing damage over large areas is to plough early in the autumn and keep down weeds by frequent harrowing. Poisoned cereal bait may be used in spring before planting a crop in a recently ploughed badly-infested field. This is made of 25-35 lb. of wheat bran thoroughly mixed while dry with ½ lb. of Paris green, or lead arsenate, or powdered white arsenic. This mixture is then made into a paste with 1 U.S. quart of any cheap syrup in 2 or 3 U.S. gals. of water, with the addition of 6 finely minced oranges or lemons. The bait should be scattered over the land in little heaps, being more readily

found by the cutworms if covered with bunches of freshly mown grass or weeds, or a tea-spoonful may be put at the base of each garden plant liable to attack. Another good bait is obtained by spraying a patch of clover with Paris green, ½ lb. to 50 U.S. gals. water, or with lead arsenate, 3 lb. paste or 2 lb. powder to 50 U.S. gals. water. One hour after spraying, the poisoned grass is cut with a scythe and scattered in little heaps over the infested land. In cases where the cutworms become so numerous that they adopt the marching habit, they may be stopped by laying rows of poisoned bait 10 feet apart, with a seed drill, across the line of progress. They may also be stopped by ploughing a furrow in front of them and destroying them with kerosene when they have gathered in it. Paper wrappings and tin collars are often used as a protection, and Bordeaux mixture is an excellent repellent, but it is often cheaper and more effective to collect the cutworms by hand and destroy them.

GOODWIN (W. H.). **The Plum Curculio. Spraying with Arsenate of Lead proves Best Means of Control.**—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster*, ii, no. 4, April 1917, pp. 113–116, 4 figs. [Received 19th June 1917.]

Conotrachelus nenuphar (plum curculio) is a pest of plum trees native to North America, where, however, it now attacks apples, cherries, apricots and peaches, and sometimes pears, quinces and crab-apples. It can be effectively controlled by shaking the trees and collecting the weevils on canvas and afterwards destroying them, provided that this is done consistently for 6 or 8 weeks; this method is, however, so expensive as to be prohibitive. The best results have been obtained by spraying with a mixture of 2 to 3 lb. of lead arsenate paste with 2-3-50 Bordeaux and 2 lb. of soft soap, applied twice, just after the plums and cherries have bloomed, and again two weeks later, without causing any injury to the fruit or foliage.

GOSSARD (H. A.). **The Striped Cucumber Beetle. Suggested Remedies for Controlling this Pest on Cucurbits.**—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster*, ii, no. 4, April 1917, pp. 117–120, 1 fig. [Received 19th June 1917.]

Diabrotica vittata (striped cucumber beetle) hibernates under old cucurbit vines or among grass and weeds, appearing in April and May and attacking the young cucumbers, melons, pumpkins, etc., on their first appearance. Hence it follows that an important control measure is the gathering and burning of all refuse of the plants together with all weeds and rubbish in the autumn. By planting very early varieties, the plants may have passed the danger stage before the beetles appear, and the later varieties should not be started till the beetles have disappeared. The planting of trap-crops of either young cucurbits or beans in alternate rows is a good means of protection. Another method is to dust most of the plants with tobacco, fine ashes or lime, the undusted ones, on which the beetles naturally prefer to feed, being sprayed with a solution of 6 lb. of lead arsenate paste in 50 U.S. gals. of water, thus acting as traps. A dusting of lime that has been impregnated with the odour of kerosene by mixing 1 pint of kerosene with ½ peck of lime and then thoroughly stirring this into ½ a bushel

of lime, acts as a good repellent. The main crop may be protected by spraying with Bordeaux mixture, 2 lb. copper sulphate, 2 lb. quick lime (or 3 lb. ground hydrated lime) and 50 U.S. gals. of water. To this must be added 6 lb. lead arsenate paste, or 3 lb. of powdered arsenate of lead.

Heat kills Insects in Stored Provisions.—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster,* ii, no. 4, April 1917, p. 135. [Received 19th June 1917.]

Beetles, moths, mites and similar insects that live in flour, cereals, dried fruits and other stored provisions may be destroyed by heating the infested foods in an oven at 135° F. for 15 minutes; this treatment does not injure the quality of the food for further use.

Goodwin (W. H.). **The Currant Worm. Arsenicals and Hellebore may save Currants and Gooseberries.**—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster,* ii, no. 6, June 1917, pp. 197–198.

The larvae of *Pteronus ribesii*, Scop. (currant and gooseberry sawfly) are best controlled by spraying the under-sides of the leaves with arsenate of lead, 3 lb. to 50 U.S. gals. of water. Paris green can also be safely used at the rate of ½ lb. to 50 U.S. gals. if a little lime be added. The plants may also be dusted with dry arsenate of lead, 1 lb. being mixed with 5 or 6 lb. of lime or flour, or, in cases where this would be dangerous owing to the fruit being nearly ripe, they may be dusted with fresh hellebore mixed with 5 parts of dry lime or flour. If a spray is preferred, 1 lb. of fresh hellebore should be mixed in 10 to 12 U.S. gals. of water.

Gossard (H. A.). **The Colorado Potato Beetle. Hand Picking and Arsenicals advised for Tuber Crops.**—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster,* ii, no. 6, June 1917, pp. 199–202, 2 figs.

Collecting the adults and egg-masses of *Leptinotarsa decemlineata* (Colorado potato beetle) by hand has been found by small growers to be efficacious and to reduce the cost of spraying, but on a large scale spraying is cheaper. Experience has shown that a mixture of Paris green and arsenate of lead is better than either alone, the former being much more rapid in its action, but also disappearing more quickly from the plant, no trace of it being found a week after application.

This beetle is naturally controlled by various species of Coccinellids that feed on the eggs and young larvae, by *Lebia grandis* and other ground-beetles, the spined soldier bug [*Podisus spinosus*], and *Perilloides* (*Perillus*) *circumcinctus*, which destroy the larvae. A Tachinid fly is often a common parasite of the larvae. Among birds, the rose-breasted grosbeak is its greatest enemy, others being robins, thrushes, crows, sparrows and cuckoos. Toads also eat the larvae voraciously.

King (J. L.). **The Lesser Peach Tree Borer** (*Synanthedon pictipes*, **G. and R.**).—*Ohio Agric. Expt. Sta., Wooster,* Bull. no. 307, January 1917, 49 pp., 21 figs. [Received 29th June 1917.]

Aegeria (*Synanthedon*) *pictipes*, G. & R. (lesser peach-tree borer) attacks plum and cherry trees generally in diseased and wounded

areas on the upper part of the trunk and branches. The moths appear in May and early June and there is a small second brood during the summer. As in the case of *Aegeria* (*Sanninoidea*) *exitiosa* (peach-tree borer), the most effective means of control is "worming," or digging out the larvae from their burrows. This should be done thoroughly at least twice a year, during October and November, and again in the latter part of May or early in June. All loose parts of dead bark should be removed and the surrounding bark cut with a clean edge, always with the grain of the wood. The wood so exposed should be treated with a strong lime-sulphur solution or thick Bordeaux mixture. *A. pictipes* has several natural parasites, including a new species of *Elachertus* that kills the host after the formation of the cocoon, *Bracon mellitor*, Say, and *Microbracon dorsator*, Say, which destroys the host in the cocoon before the pupa is formed. From the pupae, *Conura* sp. n., *Pimpla annulipes*, Brullé, two species of *Campoplex* and *Mesostermes*, have been reared. Ants are known to prey upon the larvae, the hairy wood-pecker on the pupae, and the wood pee-wee on the female moths. Descriptions of the various stages of the insect, its geographical distribution, life-history and habits are also given.

PARSONS (T. S.). **Alfalfa in Wyoming.**—*Univ. Wyoming Agric. Expt. Sta., Laramie,* Bull. no. 111, December 1916, 55 pp., 5 figs. [Received 19th June 1917.]

Insect pests of lucerne in Wyoming are not numerous; grasshoppers occasionally do some harm, but may be controlled by early cultivation. So far, the alfalfa weevil [*Hypera variabilis*] has been practically absent, reported damage by it having turned out on investigation to be due to the alfalfa looper [*Phytometra californica*]. As a control, a strip round the edge of the field and a patch in the middle should be left as bait, heavily sprayed with Paris green or lead arsenate, this part of the crop being later cut, dried, and carefully burned. Paris green may be used at the rate of 3 to 4 lb. to 100 U.S. gals. of water, soap, at the rate of 4 lb. to 100 U.S. gals. of water, being added to make the poison spread and stick. When practicable, a ditch of water should surround a badly infested field to prevent the spread of this pest.

LESNE (P.). **Les Insectes attaquant le Bois des Arbres Fruitiers.** [Insects attacking the Wood of Fruit-trees.]—*Jl. Agric. Pratique, Paris,* xxx. no. 12, 14th June 1917, pp. 222–224, 1 plate.

The insects that cause most damage to the wood of fruit-trees are Lepidoptera and Coleoptera, the BUPRESTIDAE and SCOLYTIDAE, being particularly destructive. The Buprestid, *Capnodis tenebrionis*, L., lays its eggs near the base of the trunk of peach, almond and cherry trees, and the larva eats into the sap-wood of the trunk and roots. The adults may be destroyed by shaking them from the trees, and the larvae by raising the bark over an infested spot and killing them, tar being afterwards applied to the wound. Another Buprestid, *Agrilus sinuatus*, Ol., may be controlled by laying bare the zig-zag borings of the larvae and destroying them, tar being applied as before. *Scolytus pruni*, Ratz., and *S. rugulosus*, Ratz., are two very destructive Scolytids that attack plum, pear and apricot trees, while a third,

Xyleborus dispar, F., makes a complex system of borings, on the walls of which grow certain fungi that form the sole nutriment of the larvae. Since these beetles chiefly attack diseased trees, the best means of controlling them is by careful cultivation and the removal and burning of all dead branches and twigs. The Longicorn, *Cerambyx scopolii*, Fuessl., also attacks diseased and dying trees, chiefly apple and cherry.

Cossus cossus, L. (*ligniperda*, F.) and *Zeuzera pyrina*, L., are two very destructive Lepidopterous pests. The large gregarious caterpillars of *C. cossus* bore into the trunks of healthy apple, willow and elm trees near the ground level. As these galleries open to the exterior by a common and conspicuous orifice, this pest can be readily controlled by filling the borings with gelatinous capsules of carbon bisulphide and afterwards sealing the aperture with clay. The same method can be employed to destroy the solitary larvae of *Z. pyrina*, which bore into the wood of healthy lime and fruit trees.

Berlese (A.). **Los Insectos entomófagos y su Utilización en Provecho de la Agricultura.** [Entomophagous Insects and their Employment for the Benefit of Agriculture.]—*Bol. Agric. Técnica y Económica, Madrid*, ix, no. 101, May 1917, pp. 417–428.

This paper gives a general review of the work done in utilising beneficial insects against agricultural pests.

Reports on the State of the Crops in each Province of Spain on the 24th May 1917.—*Bol. Agric. Técnica y Económica, Madrid*, ix, no. 101, May 1917, pp. 445–466.

In Cordova oaks are seriously infested by *Tortrix viridana*, for which no practical method of control is known at present. *Colaspidema* sp. is expected to do serious injury to lucerne fields in Gerona, unless remedial measures are undertaken.

Elegi (—). **Difendiamo l'Olivo dai suoi Nemici.** [Let us defend the Olive against its Enemies.]—*Riv. Agric., Parma*, xxiii, no. 25, 22nd June 1917, pp. 339-340.

This paper deals with the control of olive pests in Italy, but contains no new matter.

La Lotta contro la " Cochylis " in Isvizzera. [The Control of *Clysia ambiguella*, Hb., in Switzerland.]—*Minerva Agraria, Milano*, ix, no. 7–8, 15th–30th April 1917, pp. 92–93. (Abstract from *La Terre Vaudoise*, no. 39, 1916.) [Received 27th June 1917.]

This paper is a résumé of the report by Prof. Faes of the Lausanne Viticultural Station on experiments in the control of *Clysia ambiguella*, Hb., conducted in 1915. Nicotine sprays, the proprietary product Golazine, and pyrethrum powder gave satisfactory results. The pyrethrum powder was obtained from locally-grown plants and proved superior to that of Oriental origin.

Grandi (G.). **Contributo alla Conoscenza degli "Agaonini" (Hymenoptera, Chalcididae) dell' Eritrea e dell' Uganda.** [A Contribution to the Knowledge of the Agaoninae of Eritrea and Uganda.]—Separate (42 pp.), dated 1917, from *Bull. Soc. Entom. Italiana, Florence,* xlviii, 1916. [Received 29th June 1917.].

The Agaoninae from Eritrea and Uganda described in this paper include four species living in figs.

De Gregorio (A.). **Observations upon *Icerya purchasi* and its Natural Enemy *Novius cardinalis* in Sicily (2.).**—*Internat. Rev. Science and Practice Agric., Mthly. Bull. Agric. Intell. and Pl. Dis., Rome,* vii, November 1916, p. 1722. (Abstract from *Il Naturalista Siciliano,* xxiii, N.S., nos. 1–6, pp. 5–17, 4 plates, Palermo, 1916). [Received 22nd June 1917.]

Icerya purchasi, Mask., has recently been found at Palermo, but has been kept in check by the Coccinellid, *Novius cardinalis,* Muls., a stock of which was obtained from the Zoological Laboratory at Naples. Another species, *Chilocorus bipustulatus,* L., also aids in the control. The young larvae of *I. purchasi* may be quickly killed by spraying the under-surfaces of the leaves with soap-suds.

Aharoni (J.). ***Eurytoma* sp., a Hymenopterous Pest of Almond Trees in Palestine.**—*Internat. Rev. Science and Practice Agric., Mthly. Bull. Agric. Intell. and Pl. Dis., Rome,* vii, no. 11, November 1916, pp. 1723–1724. (Abstract from *Der Tropenpflanzer, Berlin,* 1916, Year 19, no. 6, pp. 317–322). [Received 22nd June 1917.]

The larva of a species of *Eurytoma* destroys one-half of the almond fruits in Palestine every year, mainly attacking old trees and causing the almonds to turn black. This pest seems to have few natural enemies, which accounts for its general distribution. The larvae of a Microlepidopteron and of a Curculionid have been found in blackened almonds, as well as a Dipterous larva in Arabian almonds; it is therefore uncertain whether *Eurytoma* alone is responsible. The eggs have not been discovered, though it is known that the adults attack the young ovaries at the beginning of March and the larvae appear towards the end of May. By harvest time (mid-July to the beginning of August), the kernel has been completely eaten, but the larvae hibernate in the shell, till February or March. The insect can be kept in check only by picking and burning all the fruits that have turned black, but from which the adults have not escaped.

Stone (G. E.). **Studies concerning the Application of Hydrocyanic Acid as an Insecticide.**—*Internat. Rev. Science and Practice Agric., Mthly. Bull. Agric. Intell. and Pl. Dis., Rome,* vii, no. 12, December 1916, p. 1858. (Abstract from *Jl. New York Bot. Garden, New York,* 1916, xvii, no. 199, pp. 97–103.) [Received 26th June 1917.]

Hydrocyanic acid gas, though a powerful insecticide, has the disadvantage of scorching the leaves and flowers of plants on which it is used. As the result of experiments upon plants grown under various

degrees of light intensity and soil moisture, the author has found that the sensitiveness of the plants varies inversely with the light intensity and directly with the soil humidity. Hence, it follows that fumigation may most safely be practised in dry weather and on a clear starlight night without a moon, following on a period of 4 or 5 sunny days, which will have increased the resistance of the plant cells.

JOHNSTON (J. B.) & CARDIN (P.). *Aleurocanthus woglumi*, **a Hemipteran Pest on Several Cultivated Plants in the Island of Cuba.**—*Internat. Rev. Science and Practice Agric., Mthly. Bull. Agric. Intell. and Pl. Dis., Rome*, vii, no. 12, December 1916, p. 1826. (Abstract from *Modern Cuba—Cuba Moderna, Havana*, 1916, iv (viii), no. 6, pp. 8–11.) [Received 26th June 1917.]

Aleurocanthus woglumi is recorded from citrus, coffee, mango and other plants in Cuba. A description of this Aleurodid is given.

STEHLIK (W.). **A New Remedy for the Successful Control of Elateridae.** *Internat. Rev. Science and Practice Agric., Mthly. Bull. Agric. Intell. and Pl. Dis., Rome*, viii, no. 1, January 1917, p. 172. (Abstract from *Blätter für Zuckerrübenbau, Berlin*, 1916, Year xxiii, no. 14, pp. 165–167.) [Received 26th June 1917.]

Large numbers of the beetles, *Agriotes lineatus* and *A. obscurus*, were found in many localities feeding on the pollen of seeding sugar-beets. The best method of control consists of leaving in the fields trap-plots of seeding beets from which the insects can be collected at frequent intervals by shaking them into an open bag waxed on the inside to prevent their climbing out. As many as 6,000 have been taken by this method in a single day.

FALLADA (O.). **Diseases and Pests of the Sugar-beet observed in Austria-Hungary during 1915.**—*Internat. Rev. Science and Practice Agric., Mthly. Bull. Agric. Intell. and Pl. Dis,, Rome*, viii, no. 1, January 1917, pp. 172–174. (Abstract from *Osterreichisch-Ungarische Zeitschrift für Zuckerindustrie und Landwirtschaft, Vienna*, 1916, part 3, pp. 107–116.) [Received 26th June 1917.]

The larvae of the beetles, *Agriotes lineatus* and *A. obscurus*, caused great damage in Bohemia, but these wireworms have not yet appeared in Hungarian beet-fields. Less numerous pests were the larvae of *Melolontha melolontha* (*vulgaris*), *Rhizotrogus aequinoctialis*, *Silpha reticulata*, *S. atrata* and *Cleonus* sp., which did little damage. The flea-beetle, *Haltica* sp., one of the worst enemies of sugar-beet, occurred in Central Bohemia and eastern and southern Hungary. A second sowing had to be carried out in districts where it appeared together with wireworms. *Agrotis segetum* was very injurious in central Bohemia, and isolated attacks were reported of the moth, *Phthorimaea* (*Lita*) sp., probably *P. atriplicella*, *Pegomyia hyoscyami* (*Anthomyia conformis*), and *Aphis rumicis* (*papaveris*). Other sugar-beet pests such as *Gryllotalpa gryllotalpa* (*vulgaris*), *Atomaria linearis*, *Cassida nebulosa*, *Tetranychus telarius*, *Julus* sp., *Athalia colibri* (*spinarum*) and *Tipula oleracea* caused no damage during 1915.

FEYTAUD (J.). **Les Cochenilles de la Vigne.** [Vine Scale-Insects.]—*Rev. Viticulture, Paris,* xlvi, nos. 1197, 1198, 1199, 7th, 14th, 21st June 1917, pp. 357–362, 373–376, 389–395.

The chief scale-insects attacking the vine in France are :—*Pulvinaria vitis,* L., *Eulecanium* (*Lecanium*) *persicae,* F., *E.* (*L.*) *corni,* Bch., *Targionia vitis,* Sign., and *Pseudococcus* (*Dactylopius*) *vitis,* Nied. Of these *E. persicae* and *E. corni* occur on many host-plants, but the other three are more exclusively pests of the vine. The universal pests, *Icerya purchasi* and *Aulacaspis* (*Diaspis*) *pentagona,* have recently been introduced into the south-east of France, but steps are being taken to prevent their spread. *Targionia vitis* is confined to the Mediterranean region, but *Pseudococcus vitis* is abundant in Tunis, Palestine and the Crimea. In France there are, normally, two generations a year, three or four in Tunis and more in the east. *Margarodes vitium,* Giard, is a remarkable subterranean species attacking vines in Chile, the female depositing eggs to the number of about 600 in the top layer of the soil. The young larvae attach themselves to the roots and, after the first moult, encyst by means of a yellowish cutaneous secretion in a globular form, commonly called "ground pearls," in which state they remain for months or even years, according to the conditions of moisture. The injury caused by this species is serious and resembles that of *Phylloxera* ; hence the importance of preventing its introduction.

Owing to the exudation of sap caused by the attacks of these scale-insects, vines are attacked by numerous fungi, some of them (*Capnodium, Limacinia, Fumago*) causing sooty mould, which injures the plant by obstructing the stomata. In countries such as Palestine, with a warm dry climate and light soil, *Pseudococcus vitis* adapts itself to a life in the soil, where it lives a commensal existence with the fungus, *Bornetina corium,* on the vine roots, causing a special disease. A more intimate symbiosis exists between some scale-insects and yeast fungi, the latter aiding their digestive function and thus being advantageous to the insect, e.g., *Lecaniascus polymorphus* with *Coccus* (*Lecanium*) *hesperidum,* L., and *Pulvinaria floccifera,* Westw. Pathogenic fungi that attack the Diaspids are *Myriangium duriaei, Acrostalagmus coccidicola, Acremonium coccophilum, Hyalopus yvonis,* and *Sphaerostilbe coccophila,* the last also controlling *Aspidiotus perniciosus* in America, and *Aulacaspis pentagona* in Japan. The Lecaniids are controlled by *Cordiceps clavulata, Sporotrichum lecanii,* and *Verticillium heterocladum.*

Insects, such as earwigs, Coccinellids and Chrysopids, exercise an important natural control over Coccids, which are also parasitised by Chalcids and Diptera. The larvae of the Noctuid, *Eublemma* (*Erastria*) *scitula* lives on the eggs of Coccids and controls *Ceroplastes rusci* and *Saissetia* (*Lecanium*) *oleae* in Algeria and the south of France. The wasp, *Celia troglodytes,* Lind., is one of the chief enemies of *Pulvinaria vitis.* Among the Chalcids, the APHELININAE are exclusively parasitic on Coccids. A large number of Encyrtids, *Ericydnus ventralis,* Dalm., *Blastothrix schoenherri,* Dalm., *Encyrtus duplicatus,* Nees, *Eucomys swederi,* Dalm., the Pteromalids, *Eunotus cretaceus,* Walk., and *Pachyneuron coccorum,* L., and the Eulophids, *Eulophus scutellaris,* Nees, and *Aphelinus scutellaris,* Dalm., are all parasitic on scale-insects. The

Dipteron, *Leucopis annulipes*, Zett., the mite *Hemisarcoptes coccisugus*, Lign., several pseudoscorpions, *Chelifer cancroïdes*, L., *Chthonius trombidioïdes*, Latr., etc.) and insectivorous birds, especially blue tits, naturally control scale-insects in France, while the American species, *Aspidiotus uvae*, Comst., is checked by a mite of the genus *Tyroglyphus.*

Powdering with sulphur or lime, spraying with copper or nicotine solutions during the period of vegetation, and mechanical treatments, such as close pruning, the crushing of the insects, brushing and decortication, are only partly effective against scale-insects, the best results being obtained by the winter use of gaseous or liquid insecticides. The best gases are sulphur dioxide, tobacco smoke and hydrocyanic acid, and the best liquids pure petroleum or petroleum emulsion according to Riley's formula :—petroleum 10 quarts, water 6 quarts, ordinary soap 1 pound, diluted for use with 7 to 10 times its own volume of water. Barsacq's formula is 8 pints of petroleum, $1\frac{1}{8}$ pints of 90° alcohol, and $4\frac{1}{2}$ oz. of Panama wood [*Quillaia saponaria*], which must be macerated in the alcohol for several days and then mixed with the petroleum, being stirred all the while. For use, it must be diluted with 10 times its volume of water. Marchal's formula is $1\frac{4}{5}$ pints of petroleum, $2\frac{2}{5}$ pints of seed oil, 4 lb. of black soap and $9\frac{3}{5}$ pints of water. This mixture may be used as a wash, or as a spray, if diluted with once or twice its own volume of water. In America the use of badly prepared emulsions is avoided by means of the Kerowater machine, which mixes the petroleum and water in the required proportion. A control measure practised in Gironde is the whitewashing of the vine stocks with milk of lime, the application of which has also a mechanical value in dislodging the insects. In Italy, a lime-sulphur wash is largely used, composed of 20 lb. of fat lime, 40 lb. of sulphur and 20 gals. of water. Preventive measures must include the inspection of imported stock and fruit products, the fumigation of suspected consignments, and the immediate and complete destruction of locally infested vines.

GOUGH (L. H.). **The Rate of Increase of the Pink Boll Worm in Green Bolls in the Period July to November 1916.**—*Ministry Agric. Egypt, Tech. Sci. Service, Cairo,* Entom. Sect. Bull. no. 13, 25th November 1916, 26 pp., 13 tables. [Received 28th June 1917.]

Pectinophora (*Gelechia*) *gossypiella* was imported into Egypt less than 10 years ago, and its increase has been enormous. The July infestation of 1916 was due to the progeny of moths which had hibernated as larvae, and the increase in numbers continued uniformly, owing to breeding being continuous and unchecked, till the maximum was reached during the third week in September, at which time there were at least 4,500 individuals to each 1,000 cotton plants. This pest now occurs wherever cotton is grown in Egypt; in the last week of October 87 per cent. of the green bolls in Lower, 78 per cent. in Middle, and 60 per cent. in Upper Egypt were attacked by it. *Earias* [*insulana*] (cotton boll worm) appears to have sunk to the position of a minor pest, not only relatively to the pink boll worm, but also absolutely.

Mosséri (V.). **Coup d'œil rétrospectif sur la Culture du Tabac en Egypte.** [A retrospective Glance at Tobacco Cultivation in Egypt.]—*Bull. Union Agriculteurs d'Egypte, Cairo,* no. 119, March-May 1917, pp. 53-54. [Received 28th June 1917.]

Tobacco foliage in Egypt is often destroyed by the larvae of *Prodenia litura* (cotton worm), which does so much damage to the leaves of cotton plants, though this insect can never be a serious enemy to tobacco, as the latter is a winter crop maturing in April and May, before the destructive generation of this moth has appeared. This is not the case with *Agrotis ypsilon*, which is most active and dangerous during the growth of the tobacco crop. As however Egyptian tobacco is not grown for cigars, for which purpose every leaf must be without spot or perforation, the attacks of these insects merely reduce the total weight of the crop, without lowering its market value.

The Mango Hopper.—*Planters' Chronicle, Bangalore,* xii, no. 22, 2nd June 1917, pp. 280-283.

The mango hopper [*Idiocerus* sp.] in certain years causes extensive damage to mango trees in Southern India. The eggs are laid singly in slits on the shoots and leaves, and the young reach maturity in about 10 days. Both young and adult swarm on the tender parts of the tree and drain the tree-sap from the young shoots and flower stalks, causing the flower buds to wither. The leaves and the ground beneath the tree become covered by a sweet, sticky juice, which attracts thousands of flies, bees and other insects. Mechanical control by means of trapping is impracticable owing to the size of the trees, but early morning spraying with an insecticide every 10 or 12 days from the first appearance of the flower-shoots has proved very effective. The solution used consisted of 1 lb. of fish oil resin soap in 10 gals. of cold water, applied with a knapsack sprayer.

Hardenberg (C. B.). **South African Bagworms: their Transformations, Life-History, and Economic Importance. Part 1.**—Separate from *Annals of the Natal Museum, London,* iii, no. 3, May 1917, pp. 619-686, 6 figs., 3 plates. [Received 25th June 1917.]

The bagworms, of which some 24 species are known in S. Africa, belong to the families Psychidae, Cossidae and Tineidae. The most important is the Psychid, *Chalioides* (*Acanthopsyche*) *junodi*, which causes great damage to plantations of *Acacia mollissima* (black wattle). Fifteen years ago its native host-plants were the thorn bushes consisting of various species of *Acacia*, which, together with five other species, it has quite deserted in favour of the black wattle. Thus there is the fear that the other species which feed on wattle occasionally, or on vegetation in or near the plantations, may in the near future also develop a preference for this tree.

The fecundity of the females, most of which are wingless, is very great, the female of *C. junodi* having been known to lay 3,000 eggs. The incubation period is as long as two months and there is only one generation a year. The young larvae on hatching out are passively distributed during the first instar, chiefly by the wind, heavy storms being an almost daily occurrence during the hatching period from the

end of August till the beginning of September. The larvae may thus be carried for miles, and though countless numbers perish, others give rise to the sudden heavy infestations of plantations previously free from them. Before beginning to feed the young larvae spin their silky bags, and these become entangled on the feet of birds and may be carried long distances to new situations. The larvae damage trees by completely defoliating them, beginning at the top and working downwards, so that by December the majority of the trees are bare and reddish brown in colour. The greatest enemy of the larvae is moisture, which quickly proves fatal to them, either by collecting in the bags and inducing fungus disease, or by causing a digestive disorder due to eating wet food. Four species of Hymenopterous parasites and the same number of TACHINIDAE have been bred from the caterpillar of this bagworm, but under the most favourable conditions only 24 per cent. are killed by them. Predaceous enemies, such as the yellow weaver bird and two species of rats, destroy large numbers, as also does a deadly fungus disease due to *Isaria psychidae.* This however does not afford an effective control owing to the difficulty of distributing the spores so as to reach the tops of the trees where the young larvae are feeding, the result being that only 22·5 per cent. are destroyed by it.

SWINGLE (D. B.) & MORRIS (H. E.). **Arsenical Injury through the Bark of Fruit Trees.**—*Jl. Agric. Research, Washington, D.C.*, viii, no. 8, 19th February 1917, 35 pp., 11 tables, 6 plates. [Received 26th June 1917.]

Extensive experiments undertaken to determine whether trees are injured at the crowns by arsenical spray mixtures are here described. The tests were made almost entirely upon apple trees, the solutions being applied to the trunk, branches or larger roots by means of an absorbent cotton bandage protected with medical gauze and moistened with distilled water, and in some cases covered with dental rubber. In the case of the crown, the treatment was effected by removing some inches of soil and pouring the solution round the tree, afterwards lightly replacing the soil, thus giving, as nearly as possible, the conditions which obtain after spraying. In trees with smooth bark it was found that injury began round the lenticel as a small indefinite zone of a darker colour. For a week or two this became darker in colour, and increased slightly in size. It soon ceased to grow, became nearly black in colour and very sunken, so that a crack appeared between the injured and healthy tissues. Absorption through a wound caused a long narrow streak running upwards and downwards through the wood. The leaves also showed signs of injury, becoming first dull and of a lighter green, either over the whole surface or in spots or patches, which later became dry, brown and crisp. Of all the arsenical insecticides, calcium arsenite and arsenic trioxide are the most injurious when they reach the inner-bark. This happens on old trees and those with rough bark by way of the cracks in the bark and through wounds, the injury being much worse on wounded limbs. Both washed and unwashed chemicals of the purest brands caused severe injuries, the addition of lime apparently making no difference. The variety of apple had no influence on the extent of

the injury, but it varied with the season, being more rapid just after the leaves appeared and slower in the autumn. The injury to the crowns consisted in the bark below the surface becoming very dark and so disintegrated that it could be picked apart with the fingers, which might have been due to the invasion of saprophytic micro-organisms. It is doubtful whether general poisoning has ever occurred to any considerable extent as the result of orchard spraying, though it should be possible to produce it experimentally.

HINDS (W. E.) & DEW (J. A.). **The Grass Worm or Fall Army Worm.**—*Alabama Agric. Expt. Sta., Montgomery,* Bull. no. 186, September 1915, 92 pp., 4 plates. [Received 26th June 1917.]

The list of natural enemies of *Laphygma frugiperda* [see this *Review*, Ser. A, i, p. 518] has been enlarged by the addition of several positively identified species, and now stands as follows: predaceous Hymenoptera: *Polistes bellicosus, P. canadensis, Pelopaeus cementarius* and *Ammophila* sp.; Coleoptera: *Calosoma calidum, C. scrutator, Tetracha carolina, Galerita bicolor, Lebia analis* and *Callida punctata*; parasitic Hymenoptera: *Apanteles laphygmae* (?) and *Henicospilus purgatus*; parasitic Diptera: *Nemoraca leucaniae, Sarcophaga georgiana, S. diversipes* and *S.* (*Helicobia*) *helicis.*

HINDS (W. E.). **Boll Weevil in Alabama.**—*Alabama Agric. Expt. Sta., Auburn,* Bull. no. 188, March 1916, 64 pp., 6 plates. [Received 26th June 1917.]

This bulletin deals further with the introduction and spread of the boll-weevil [*Anthonomus grandis*] in Alabama [see this *Review*, Ser. A, ii, pp. 649]. Since the infestation must be regarded as permanent, all possible precautions should be taken in cotton cultivation, such as reducing the cotton acreage, where the necessary labour for cultivation and weevil control is not available, change of crops in a planned rotation, increase of the nitrogen content of the soil by growing leguminous crops, deep preparation of the soil, selection of an early variety of wilt-resisting cotton, and the maintenance of a uniform date for planting. The weevils themselves may be controlled by many mechanical devices, such as the chain drag or cultivator, hand-picking when squaring begins, destroying infested squares, and collecting the insects with the hoop and bag apparatus. The cotton should be promptly harvested, and the best seed for weevil resistance should be carefully selected, after which all green cotton should be destroyed as early as possible to deprive the adult insects of their food-supply. To be effective, this stalk destruction should be done a month before the frosts and should be effected by burning and not by the old-fashioned grazing method. The stalks may be cut just below the surface of the soil, piled in rows and burned as soon as the leaves are dry enough, the adult weevils and all immature stages being destroyed in this way. Another method of stalk destruction is that of deep ploughing in early autumn, a stalk-bender being used to lay the stalks flat upon the ground, so that the following ploughshare completely buries them at the bottom of the furrow.

The principal factors in the natural control of *A. grandis* are: (1) climatic conditions, especially heat and drought in summer, which cause a mortality of 25 per cent.; (2) predaceous insects, principally fire ants [*Solenopsis geminata*], which destroy 16 per cent.; (3) plant proliferation, i.e., the rapid growth of new cell-tissue after an injury, often resulting in the crushing of the newly-laid eggs, 12½ per cent. being thus destroyed; (4) parasites, which however are not to be depended on, as they destroy only 4 per cent. The help of birds is a welcome, but not dependable natural factor in boll-weevil control.

Two other weevils often mistaken for *A. grandis* are the cocklebur weevil [*Baris transversa*, Say] which breeds in cocklebur, and the ragweed weevil in ragweed, while the boll-weevil breeds only in cotton squares and bolls.

STARCHER (G. C.), PELTIER (G. L.) & HINDS (W. E.). **Common Orchard Pests and their Control.**—*Alabama Polytec. Instit., Auburn*, Exten. Serv. Circ., no. 7, March 1917, 16 pp. [Received 26th June 1917.]

This circular contains a condensed spraying calendar for apple orchards, and for insect pests of the peach, plum and cherry. The usual controls for San José scale [*Aspidiotus perniciosus*], plum curculio [*Conotrachelus nenuphar*], codling moth [*Cydia pomonella*] Aphids, borers and bark-beetles are given, with formulae for lead arsenate, nicotine and lime-sulphur washes, and a dilution table for dormant and summer spraying with concentrated lime-sulphur, hydrated lime-sulphur and Bordeaux mixture.

HINDS (W. E.). **Cucumber and Canteloupe Insect Control.**—*Alabama Expt. Sta., Auburn*, Farmers' Exten. Service Leaf., no. 17, [n. d.], 1 p. [Received 26th June 1917.]

The chief insects attacking cucurbitaceous crops are the striped cucumber beetle [*Diabrotica vittata*] and the 12-spotted cucumber beetle [*D. soror*], which are controlled by applying air-slaked lime or ashes mixed with powdered lead arsenate at the rate of 1 lb. to 10 lb. of lime or ashes, or by spraying with Bordeaux mixture, 2 U.S. gals. of which should be mixed with 1 oz. of powdered lead arsenate. The melon aphis [*Aphis gossypii*] is controlled by removing the infested tips of the leaves, and by under-spraying with kerosene emulsion or nicotine solution. The melon worm [*Diaphania hyalinata*] and the pickle worm [*D. nitidalis*] are best controlled by planting a trap-crop, the buds on which should be picked and destroyed every week, while the ripening fruit should be sprayed every two weeks with lead arsenate.

WATSON (J. R.). *Florida Univ. Agric. Expt. Sta., Gainesville.*—Press Bulls. nos. 233, 249, 250, 252, 256, 257, 259, 260. [Received 27th June 1917.]

These popular bulletins deal with some of the common insect pests of Florida and the best means of controlling them [see this *Review*, Ser. A, i, p. 204, iii, 176, v, 305].

SEVERIN (H. C.) & GILBERTSON (G. I.). **Grasshoppers and their Control.**—*South Dakota Agric. Expt. Sta., Brookings.* Bull. no. 172, February 1917, 36 pp., 15 figs. [Received 28th June 1917.]

The grasshoppers that do so much injury to lucerne crops in S. Dakota are *Melanoplus differentialis*, Thom. (differential locust), *M. femur-rubrum*, De G. (red-legged locust) and *M. bivittatus*, Say. (two-lined locust), which are all non-migratory forms, and to a less extent *M. atlantis*, Riley (lesser migratory locust). Their natural enemies are chiefly birds, especially plovers, hawks, blackbirds, crows, owls, robins and several kinds of sparrows. Toads, lizards, ground squirrels and mice also destroy large numbers of young and adult insects. At times, certain parasitic flies exert a complete control. Under favourable conditions of high temperature and great humidity, two fungus diseases attack and destroy large numbers. Grasshopper eggs are destroyed by the larvae of the MELOIDAE (blister beetles), as well as by both larval and adult ground-beetles. Control measures directed against the eggs consist in deep winter ploughing followed by harrowing and, if necessary, rolling to prevent the emergence of any young that may hatch out. The adults may be destroyed by means of poisoned bran bait consisting of coarse flaked bran 25 lb., white arsenic or Paris green 1 lb., lemons or oranges 6, cheap molasses 2 quarts, water 4 U.S. gals., or by the less effective but far cheaper Criddle mixture, composed of:—fresh horse-droppings free from straw 50 lb., white arsenic or Paris green 1 lb., lemons or oranges 6-8. Mechanical methods, such as the use of the hopper-catching machine and of the hopperdozer and the burning of weed patches in spring, have also proved effective in reducing grasshopper outbreaks.

FAUROT (W. F.). **Spraying Machinery.**—*Missouri State Bd. Hortic., Columbia*, Qrtly. Bull. no. 65, vi, no. 1, January 1914, 99 pp., 14 plates. [Received 28th June 1917.]

The author lays stress on the fact that time is the most important element in spraying. Hence, an efficient spraying outfit should include a supply tank and storage tank, and, unless the one can be loaded from the other by gravity, it should be equipped with a tank-filler, which also can be used for transferring the load to the spray tank. Three kinds of tank-fillers are described and illustrated.

PETHERBRIDGE (F. R.). **Spraying for Apple Sucker** (*Psylla mali*).—*Ann. App. Biol., London*, ii, no. 4, April 1916, pp. 230–234. [Received 28th July 1917.]

The experiments detailed in this paper, which are a continuation of the work described in a previous publication [see this *Review*, Ser. A, iii, p. 278], indicate that lime and salt may be effective in preventing a large proportion of the eggs of *Psylla mali* from hatching. Lime wash was fairly effective. For spraying after the suckers had hatched, soft soap 10 lb., and nicotine (98 per cent.) 8 oz., to 100 gals. water, proved effective in killing the insects. Treacle 6 lb., nicotine 8 oz., to 100 gals. water also formed a wash which penetrated well and was effective. Spraying to prevent the eggs from hatching was found insufficient to keep the insect under control and should be followed by the second spraying to kill those which have hatched.

Howard (W. L.). **Planting and Care of an Orchard.**—*Missouri State Bd. Hortic., Columbia*, Qrtly. Bull. no. 62, vi, no. 1, January 1914, 15 pp., 1 fig. [Received 28th June 1917.]

This bulletin which deals chiefly with the planting and cultivation of orchards, also contains brief notes on dormant spraying against the San José scale [*Aspidiotus perniciosus*], fungicide spraying with Bordeaux mixture against apple scab, apple canker and bitter rot, and combined spraying with Bordeaux mixture or lime-sulphur and lead arsenate against fungus diseases and insect pests such as *Cydia pomonella* (codling moth) and *Anthonomus quadrigibbus* (apple curculio).

Pellett (F. C.). **The Economic Value of Birds in Horticulture. Friends and Foes of the Fruit Grower.**—*Missouri State Bd. Hortic., Columbia*, Qrtly. Bull. no. 61, vi, no. 1, January 1914, 18 pp,, 8 figs. [Received 28th June 1917.]

It has been stated that less than 5 per cent. of insects are injurious to crops, of which they take a 10 per cent. annual toll, mainly owing to the destruction of their natural enemies and the removal of their food-plants. Birds that should be protected are the blue jay, one of the very few birds fond of hairy caterpillars such as tent-caterpillars [*Malacosoma* spp.]; the crow, which controls June beetles [*Lachnosterna*], white grubs and young field mice; the sparrow hawk, which feeds chiefly on grasshoppers and crickets; robins, thrushes and catbirds, the last of which feeds its young on cabbage worms; the cuckoo, which also eats hairy caterpillars; woodpeckers, which destroys Aphids, ants, borers and insect eggs in winter; the flicker, which eats ants in large numbers; orioles, which are particularly fond of Aphids; quails, which are in special need of protection owing to their destruction for food, and which devour the Colorado potato beetle [*Leptinotarsa decemlineata*], the striped squash beetle [*Diabrotica vittata*], the boll-weevil [*Anthonomus grandis*], the chinch bug [*Blissus leucoptera*], grasshoppers, cutworms and many other injurious insects.

A bird which is a serious pest and should be controlled is the imported English sparrow, as it feeds chiefly on grain and persecutes the beneficial native birds.

Sanders (J. G.). **Clothes Moths.**—*Weekly Press Bull. Penns. Dept. Agric., Harrisburg*, ii, no. 22, 31st May 1917.

It is calculated that a million dollars annual loss from clothes moths in Pennsylvania is a very low estimate; this may be avoided by the adoption of simple precautions, such as the thorough brushing and exposure to air and sunlight of furs and clothes before packing them away for the summer. They should be placed in a tight trunk or box, cracks, if any, being sealed with gummed paper strips, and then fumigated for 36 to 48 hours with 2 or 3 ounces of carbon bisulphide. All woollen goods such as rugs, carpets, and curtains should be carefully watched during the summer.

LEGISLATION.

State Law for Pure Spray Materials.—*Weekly Press Bull., Penns. Dept. Agric., Harrisburg*, ii, no. 23, 7th June 1917.

A State law requiring purity in Paris green, lead arsenate, lime-sulphur, and other spray materials has just been passed in Pennsylvania. This law requires a statement on the label naming and giving percentage amounts of either the active or inert ingredients in any insecticide or fungicide sold in the State. This applies to all substances put up by druggists or pharmaceutical companies for controlling insects of all kinds, or any plant diseases, and puts an end to the profitable adulteration of Paris green by adding plaster of Paris.

Arkansas Plant Act of 1917 and Rules and Regulations Pursuant Thereto.—*State Plant Board Arkansas, Little Rock*, Circ. no. 1, June 1917.

This Act provides that the Board shall keep itself informed of every new variety of insect pest and plant disease, together with the origin, locality, nature and appearance, mode of dissemination and approved methods of control of the same, and shall declare the insect pest and disease, also the plant and plant product infested, to be a public nuisance. Also that the presence of any such insect pest or disease shall be immediately reported to the Board, whose inspectors and employees shall (*a*) inspect places, plants and plant products, and things and substances connected therewith; (*b*) investigate, control, eradicate and prevent the dissemination of pests and diseases; and (*c*) supervise or cause the treatment, cutting and destruction of infested plants and plant products. Further that no plant or plant product listed as likely to become infested shall be brought into the State, nor moved within the State, without a written certificate of inspection, and that the Board shall have power to establish quarantine regulations.

By the Rules and Regulations under the Act the following insects are declared to be public nuisances and warrant the destruction or treatment of any plants or plant products infected or infested therewith :—*Euproctis chrysorrhoea* (brown-tail moth), *Lymantria* (*Porthetria*) *dispar* (gipsy moth), *Ceratitis capitata* (Mediterranean fruit fly), *Gelechia gossypiella* (pink boll-worm), *Anthonomus vestitus* (cotton square weevil), *Phthorimaea operculella* (potato tuber moth), *Aulacaspis pentagona* (West Indian peach scale).

The Board further declares the following insect pests and any nursery stock infested or infected therewith to be public nuisances of such a nature that their dissemination on nursery stock should be prevented :—*Aspidiotus perniciosus* (San José scale), *Eriosoma lanigerum* (woolly aphis), *Dialeurodes citri* and *D. rubifera* (citrus white-flies) and *Chrysomphalus tenebricosus* (gloomy scale). A list of all the plants likely to become infested with all the above pests is given. As regards nursery stock, the Act provides that it shall not be sold or moved within the State without a certificate of inspection, nor brought into the State without a permit certificate; that common carriers must not accept shipment without proper certificates; that shipments without certificates must be held; that the Board has power to hold any shipment whether labelled or not; that all foreign shipments are subject to inspection; that all nurseries in the State shall be inspected once a year, or whenever it is deemed necessary.

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Worsham (E. L.). **Annual Report of the State Entomologist for 1914.** —*Georgia State Bd. Entom., Atlanta,* Bull. no. 42, January 1915, pp. 10–20, 12 figs. [Received 29th June 1917.]

Experiments in control of the insect pests of the pecan (*Carya olivaeformis*) have been successfully made, owing to the increasing importance of the pecan industry. *Cydia* (*Enarmonia*) *caryana* (pecan shuckworm) does considerable damage owing to the larva boring into the young nuts in spring. They hibernate in the old shucks on the ground and may be controlled by gathering and destroying these, and also by late autumn ploughing. Against *Oncideres cingulata* (pecan twig-girdler), which also attacks hickory and persimmon trees, the best method of control is the gathering and burning of fallen twigs in the late autumn. *Hyphantria cunea* (fall webworm), of which there are two, or probably more generations a year, can be controlled by burning the nests with a torch, by twisting the nests out with a forked stick and crushing them, or by pruning them off and burning them. The shot-hole borers, especially *Xylobiops* (*Sinoxylon*) *basilaris*, attack dead or dying trees, and even healthy trees if the infestation is very heavy. All dead timber in the pecan grove and surrounding woods, should be removed and burnt, and if the beetles have become established in large numbers, the tree-trunks should be whitewashed in early spring with a thick wash containing a little table salt. The larvae of the pecan case-bearer [*Coleophora caryaefoliella* ?] attack and kill the buds in spring, having hibernated as larvae in the twigs. The moths appear in June and the young larvae feed on the leaves till they are nearly ready to fall. They may best be controlled, therefore, by spraying with powdered arsenate of lead, $1\frac{1}{2}$ lb. to 50 U.S. gals. water, at any time between mid-August and mid-September.

Spraying a field of water melons with arsenate of lead saved them from a threatened destruction by grasshoppers, which themselves were controlled by the usual poisoned bran. Early cantaloups were protected against *Diaphania nitidalis* and *D. hyalinata* by planting squash plants as trap-crops. The tomato horn-worm [*Protoparce sexta*], which is usually kept in check by parasites, can also be economically controlled by dusting with arsenate of lead mixed with flour or air-slaked lime. *Hellula undalis* (cabbage webworm) can be controlled, if sprayed with arsenate of lead when the plants are first attacked. Cultural methods are the chief safeguard against attacks by *Papaipema nebris* (*nitela*) (common stalk-borer), *Elasmopalpus lignosellus* (small cornstalk-borer) and *Diatraea saccharalis* (large cornstalk-borer). *Alabama argillacea* and *Laphygma frugiperda* were promptly controlled by dusting with arsenate of lead. Preventive measures, such as autumn and winter ploughing, are the only safeguard against injury from *Sphenophorus maidis* (the corn bill-bug).

Worsham (E. L.) & Williams (I. W.). **Annual Report of the State Entomologist for 1915.**—*Georgia State Bd. Entom., Atlanta,* Bull. no. 45, 1916, pp. 10–20. [Received 24th June 1917.]

The annual loss in Georgia due to insect pests is estimated to be between five and ten million pounds.

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Laboratory and field experiments have proved conclusively that *Nezara viridula* (green soldier bug) is a carrier of anthracnose spores from one cotton boll to another. *Laphygma frugiperda* caused extensive damage to lucerne crops, to prevent which arsenate of lead is recommended, as its use in large quantities is less injurious than that of Paris green. The best formulae for lead arsenate are:—As a spray, 3 lb. of the paste or 1½ lb. of the powder to 50 U.S. gals. of water; as a dust, 1 lb. dry lead arsenate to 5 lb. slaked lime or cheap flour. Paris green, if used as a spray, should be in the proportion of 1 lb. Paris green, to 3 lb. lime and 100 U.S. gals. of water; as a dust, at the rate of 1 lb. Paris green to 15 lb. slaked lime or cheap flour. *Tetranychus telarius* (*bimaculatus*) (cotton red spider) was abundant owing to a very dry season, but spraying with 1 or 2 per cent. commercial lime-sulphur gave good results. Where this cannot be used owing to its discolouring properties, as in greenhouses, spraying with nicoticide or drenching with water under pressure has proved efficacious. *Aphis gossypii* (melon or cotton aphis) was the most injurious Aphid.

Less common pests that were troublesome during the year were the beetle, *Macrobasis unicolor*, on potatoes, which was effectively controlled by spraying with lead arsenate; *Thyridopteryx ephemeraeformis* (bagworm) on ornamental trees, particularly evergreens, which was easily controlled by dusting or spraying with lead arsenate, and by hand picking and burning after it had entered the pupal stage; the leaf-miners, *Phyllorycter* (*Cameraria*) *hamadryadella* and *P.* (*C.*) *cincinnatiella*, on oak, which cannot be controlled when they are attacking the foliage, but since they hibernate in their mines in the leaves, these should be raked up and burned in late autumn or early spring; *Chrysomphalus* (*Aspidiotus*) *tenebricosus* (maple scale) was most effectively controlled by commercial lime-sulphur, 1 part to 10 parts of water; but this in the case of *Eulecanium* (*Lecanium*) *nigrofasciatum* was less successful than kerosene emulsion; and *Iridomyrmex humilis* (Argentine ant), which can be controlled by a slow-acting poison composed of 15 lb. granulated sugar, 7½ lb. water, and ¼ oz. tartaric acid, boiled slowly for 30 minutes and allowed to cool, when ¾ oz. sodium arsenate dissolved in ½ U.S. pint of hot water, and 8 per cent. of pure honey must be thoroughly stirred in.

Experiments are still being conducted with a view to finding a dependable and cheap dust mixture, the lightness of the outfit required and the rapidity with which the work can be done rendering it superior to the usual spray solutions.

WORSHAM (E. L.) & SPOONER (C. S.). **Annual Report of the State Entomologist for 1915.**—*Georgia State Bd. Entom., Atlanta,* Bull. no. 45, 1916, p. 20. [Received 29th June 1917.]

The pecan shuckworm [*Cydia caryana*] was efficiently controlled by autumn ploughing, and a large number of parasites were bred from the larvae, and also from those of the pecan case-bearer [*Coleophora caryaefoliella* ?], which was effectively controlled by late summer spraying with arsenate of lead. The pecan-nut case-bearer, which is a serious pest, was found for the first time in Georgia, and experimental control measures were undertaken.

LOVETT (A. L.). **Garden Insect Pests.**—*Oregon Agric. Coll. Exten. Serv., Corvallis*, Bull. no. 209, May 1917, pp. 5–7. [Received 29th June 1917.]

The usual means of control are given in this bulletin for general pests such as cutworms, grasshoppers, wireworms, flea-beetles, Aphids, the cabbage and radish maggot [*Chortophila brassicae*], the spotted cucumber beetle [*Diabrotica soror*] and the corn earworm [*Heliothis obsoleta*].

SANDERS (J. G.). **Grain Bin Sanitation.**—*Weekly Press Bull., Penns. Dept. Agric., Harrisburg*, ii, no. 24, 14th June 1917.

Large quantities of stored grain are annually destroyed by weevils through lack of care and proper storage. Infestation may be prevented by thoroughly cleaning the empty bins and spraying with a 10 per cent. kerosene emulsion, and by moving and aerating the grain. If it should become infested, it must be thoroughly fumigated, and for this reason the bins should be well built and should be separate from the barn.

South Carolina Agric. Expt. Sta., Clemson College, S.C., Press Bulls. nos. 121, 131, 132, 133, 134, 136, 137, 138, 139, 141, 142, 143, 146, 148, 149, 150, 152, 153, 154. [n. d.]

These brief and popular bulletins contain directions for the control of various insect pests including:—The army worm [*Cirphis unipunctata*], the cotton caterpillar [*Alabama argillacea*], the rice-weevil [*Calandra oryzae*, L.], the Angoumois grain moth [*Sitotroga cerealella*], the cotton bollworm [*Heliothis obsoleta*], the cotton red spider [*Tetranychus telarius*], the cabbage aphis [*Aphis brassicae*], the apple aphis [*Aphis pomi*], the melon worm [*Diaphania hyalinata*], the pickle worm [*D. nitidalis*], the squash-vine borer [*Melittia satyriniformis*], the cowpea pod weevil [? *Bruchus chinensis*], cutworms, white grubs [*Lachnosterna*], the chinch bug [*Blissus leucoptera*], whiteflies [*Aleurodes* spp.], thrips, and termites.

THOMAS (W. A.). **The Cotton Root Louse** (*Aphis maidiradicis.*)—*South Carolina Agric. Expt. Sta., Clemson College, S.C.*, Bull. no. 175, March 1914, 3 pp. [Received 29th June 1917.]

This Aphid, which is dependent upon ants for travelling from one plant to another, destroys the cotton plant by sucking the juice from the young tap-root. A temporary means of control lies in preventing the ants from establishing themselves in the spring by a system of shallow cultivation, continued till the cotton is thoroughly established in a healthy condition. Permanent control may be most satisfactorily effected by a three years' system of rotation, the best being maize, oats and cowpea hay, and then cotton. It is also of great advantage to have winter cover-crops on infested land, so as to prevent the growth of the winter food-plants for this Aphid, and thus reduce the spring infestation.

CONRADI (A. F.) & BARRE (H. W.). **Spraying Program for Orchard and Vineyard of South Carolina.**—*South Carolina Agric. Expt. Sta., Clemson College, S.C.*, Circ. no. 25, February 1914, 8 pp. [Received 29th June 1917.]

This circular contains formulae and directions for the making of lime-arsenic spray for worms in peach and apple, self-boiled lime-sulphur solution, Bordeaux mixture, a wash for tree-trunks, and nicotine solution, and gives advice as to when peach, apple, pear and plum trees and grape vines should be sprayed.

THOMAS (W. A.). **The Cabbage Harlequin or Calico Bug.**—*South Carolina Agric. Expt. Sta., Clemson College, S.C.*, Circ. no. 28, December 1915, 3 pp. [Received 29th June 1917.]

Murgantia histrionica, Hahn (harlequin bug) hibernates in the adult stage under rubbish. Maturity is reached in about two weeks from the laying of the egg and reproduction continues from early spring until stopped by the cold of autumn. The chief remedial measures are the destruction of hibernating quarters and winter food-plants by thoroughly cleaning up the garden and the planting of trap-crops of early radish, kale, turnips, mustard or rape, for which the insect shows a marked preference. The bugs may be destroyed on these by spraying with kerosene or 25 per cent. kerosene emulsion. It may also be controlled by burning, late in the evening, with kerosene torches.

LUTMAN (B. F.). **Some Studies on Bordeaux Mixture.**—*Vermont Univ. Agric. Expt. Sta., Burlington*, Bull. 196, March 1916, 80 pp. 11 figs., 4 plates. [Received 29th June 1917.]

In the course of this technical treatise on Bordeaux mixture the author states that the injuries due to flea-beetles are much more serious on unsprayed than on sprayed plants. In a normal season, not far from a quarter of the gain secured by the use of Bordeaux on potatoes may be attributed to its deterrent effect on this beetle [*Epitrix cucumeris*].

BRITTAIN (W. H.). **Two Apple Leaf Mites of Economic Importance.** —*Canadian Entomologist, London, Ont.*, xlix, no. 6, June 1917, pp. 185–189, 1 plate.

Descriptions of the damage caused by *Phyllocoptes schlectendali* (silver-leaf or rusty-leaf mite) and *Eriophyes malifoliae* (apple leaf mite) have already been noticed [see this *Review*, Ser. A, ii, p. 676]. The former is of economic importance from the fact that the mites, after feeding on the foliage during the summer, enter the twigs in the autumn through old egg-blisters of *Empoa rosae* (rose leaf-hopper) or of *Empoasca mali* (apple leaf-hopper), or by means of a lenticel. They give rise to incrustations, which frequently drop out during the following year, rendering nursery stock so unsightly as to be quite unmarketable. Neither insect seriously injures older trees, and as they are both readily destroyed by summer sprays of lime-sulphur or weak solutions of nicotine sulphate. their control should be a comparatively simple matter.

Busck (A.). **The Pink Bollworm,** *Pectinophora gossypiella.—Jl. Agric. Research, Washington, D.C.*, ix, no. 10, 4th June 1917, 27 pp., 6 plates, 7 figs.

This monograph, which contains many figures and plates and an extensive bibliography, gives minute morphological descriptions of *Pectinophora* (*Gelechia*) *gossypiella*, Saund. (pink boll-worm), and also of *Pyroderces rileyi* (scavenger boll-worm) which has often been mistaken for it. The larvae of the latter, however, never do any primary injury to sound cotton bolls, but live as scavengers in the more or less decayed dry bolls that have been injured by other insects. *Pectinophora gossypiella* on the other hand is one of the most destructive cotton insects known, and its ravages in Asia, Africa and the Hawaiian Islands amount to more than those of all other cotton pests combined. In Egypt the minimum yearly loss due to it is estimated at one-tenth the value of the crop. In the Hawaiian Islands the cultivation of cotton has practically had to be abandoned on account of it, 50 to 99 per cent. of the bolls being infested in 1915, and one-half to nine-tenths of the lint destroyed. Hitherto, thanks to the stringent regulations of the Federal Horticultural Board, this insect has not become established in the United States, but, unfortunately, the same cannot be said for Mexico and South America, where in 1915 it was introduced in Egyptian cotton seed into Brazil, and is now scattered and established throughout all the cotton regions. This calamity could have been averted by a properly enforced regulation requiring the fumigation of all imported seed. The exact extent of its distribution in Mexico is not known, but its presence constitutes a very grave menace to the American cotton fields, where its introduction would mean a permanent annual loss of millions of dollars.

Faes (H.). **Traitements effectués dans le Vignoble vaudois en 1916 contre le Ver de la Vigne (Cochylis).** [Treatments carried out in the Vaudois Vineyards in 1916 against the Vine Worm (*Clysia ambiguella*).]—*Progrès Agric. Vitic., Montpellier*, lxvii, no. 23, 10th June 1917, pp. 539–548.

The experiments recorded in this paper began at the end of May, before the flowering of the vine, at a time when no caterpillars were visible, numerous moths being still on the wing. The vines were treated with a mixture composed of 20 gals. of 1 per cent. Bordeaux mixture and 3 lb. of 10 per cent. Ormond nicotine. From the 9th June, or a month after the appearance of the earliest moths, the first small caterpillars were found hidden under the scales of the buds, and a week later experimental vines were treated with four different insecticides, viz., (1) local pyrethrum from unopened flowers, (2) local pyrethrum from full-blown flowers, (3) commercial foreign pyrethrum, a solution being made in each case of 20 lb. prepared pyrethrum soap in 18 gals. of water, and (4) Golazine, 4 lb. in 20 gals. of water. Of these, the local pyrethrum gave incomparably the best results, 6 to 20 caterpillars being alive as against 550 in the vine treated with commercial pyrethrum and from 554 to 687 in untreated vines [see this *Review*, Ser. A, v, p. 373]. The effects of treatment with Golazine and the mixture of Bordeaux and nicotine were about equally intermediate between the above, 215–237 caterpillars surviving.

The moths of the second generation appeared about the middle of July, and by the 26th numerous eggs were found on the skin of the grapes, as many as six being observed on a single grape, showing that minute care is necessary in spraying. The control of the second generation depends entirely on the destruction of the eggs, that of the larvae themselves being impossible, since they pierce the skin of the grape and are completely hidden.

At the end of July, when the number of moths began to decline, the following three insecticides were tried: (1) Bordeaux mixture (containing 1 per cent. of copper sulphate) 20 gals., and Ormond nicotine 3 lb.; (2) Bordeaux mixture 20 gals., Ormond nicotine 3 lb., black soap 2 lb.; and (3) Golazine 6 lb. in 20 gals. of water. Of these, Golazine gave the best results, less than one grape in a bunch being infested, while in the others from 1 to 4 were attacked, as against 8 to 12 in the unsprayed controls. At the vintage, it was found that the plot that had received a spring treatment of 1 per cent. Bordeaux and nicotine, followed by a summer spray of the same with black soap added to increase the wetting power, gave the heaviest yield, nearly equalled by that of the plot sprayed with Golazine in spring and the Bordeaux, nicotine and soap solution in summer. Since the action, by contact, of local pyrethrum on the larvae of *Clysia ambiguella*, both small and large, is so very marked, dead individuals, being found two hours after spraying, it is advisable to increase its cultivation as much as possible, as the present pyrethrum plantations, established by the Viticultural Station and some private individuals, are not extensive enough to supply the market. The treatment can be applied equally well to the young bunches, and to the vines before flowering or in full bloom, but it should be done early in the morning before 10 a.m., or after 4 p.m. until evening. As regards the nicotine and Bordeaux treatment, it must be remembered that nicotine, or tobacco juice, and Golazine act by absorption on the young caterpillars soon after hatching. Hence to obtain its full value the flight of the moths and the laying and hatching of the eggs must be watched; if the spraying is done too soon, the eggs are laid on the top of the insecticide and the larvae escape without injury; if too late, the large caterpillars hidden under the leaves of the flowers will escape. Of several insecticides supplied, titrated nicotine can be most highly recommended. When spraying under pressure in summer, owing to the presence of leaves, the stems must be held one by one in the hand so as to ensure the thorough wetting of the bunches, otherwise the foliage may be uselessly and wastefully wetted, while the hidden bunches remain dry.

GUÉNAUX (G.). **La Destruction des Hannetons.** [The Destruction of Cockchafers.]—*La Vie Agric. et Rur., Paris*, vii, no. 25, 23rd June 1917, pp. 441–443, 2 figs.

The simplest and easiest way of destroying cockchafers [*Melolontha*] is by catching the adults as they rest motionless on trees during the daytime, by shaking the tree or striking the branches with a pole. This should be done in May, on fine days and early in the morning between 5 and 9 o'clock, while the insects are still benumbed by cold. To be effective, this should be carried out simultaneously by all the

farmers in a given district. The beetles should be shaken into a large tank made of packing cloth, the ends of which are kept in position by poles of flexible wood. Between 4 a.m. and 7 a.m. a very large number may be collected in this way at one time, but later in the day they must be enclosed in a sack to prevent their escape. After being caught, they may be destroyed in various ways, the commonest being by plunging the sack into a vessel of boiling water, or by burning them in a wood fire sprinkled with paraffin. They are killed only with difficulty by drowning or by fumigation, and undoubtedly the best method consists in digging a ditch about 3 yards long and $1\frac{1}{2}$ yards wide and deep, beside which are placed tubs containing milk of lime. The insects are poured into these from the sacks and the liquid is stirred to prevent their escape. When sufficient have been caught the tubs are emptied into the ditch and a little lime is sprinkled over it and then a layer of earth about 10 inches thick. A compound is thus formed of considerable manurial value, since it is calculated that $3\frac{1}{2}$ oz. of these insects contain about $\frac{1}{8}$ oz. of nitrogen, about $\frac{1}{40}$ oz. of phosphoric acid, and $\frac{1}{55}$ to $\frac{1}{35}$ oz. of potash. This is equal to that of the best manure as regards phosphoric acid and potash, and is 8 times richer in nitrogen; 100 lb. of cockchafers would thus be equivalent to 800 lb. of manure of a value of about 3*s*. Other methods of control consist in trapping the insects by means of light-traps; destroying the eggs laid in the soil by means of naphthaline, which is practicable only on a small scale owing to its expense; by ploughing in the eggs to the depth of about a foot, trap-plots of light and very well tilled soil being left, as the females cannot oviposit in hard clay soils. The larvae, against which no complete control has yet been discovered, may be destroyed by fumigating the soil with benzine, potassium sulphocarbonate or carbon bisulphide, by irrigating with crude naphthaline, by manuring with superphosphate, which is also an insecticide, by planting trap-crops (especially lettuce), and by hand picking during the spring ploughing.

DASH (J. S.). **Crop Pests.**—*Ann. Rept. Dept. Agric., Barbados,* 1915–16, p. 36. [Received 28th June 1917.]

The subject matter of this report has already been noticed from an article which appeared in the *Agric. News, Barbados,* xvi, no. 393, 19th May 1917 [see this *Review*, Ser. A, v, p. 365].

RABAUD (E.). **Sur les Hyménoptères parasites des Oothèques d'Orthoptères.** [On the Hymenopterous Parasites of the Oothecae of Orthoptera.]—*Bull. Soc. Entom. France, Paris,* no. 10, 23rd May 1917, p. 178.

In the February 1917 part of the *Proc. Nat. Acad. Sci. of the United States* a new Chalcid, *Lepidoscelio viatrix,* is described, which was observed in the adult stage attached by its mandibles to the abdomen of an Acridian, *Colemania sphenarioides*, Bol., four females having been found on the same host. It is supposed that the Hymenopteron adopts this habit in order more readily to attack the eggs of its host, and this fact and hypothesis are published as something new among the Orthoptera. But the author points out that as long ago as 1877 Xambeu found specimens of *Podagrion pachymerus* beneath the wings

of *Mantis religiosa*, and suggested this same explanation for their presence. In the following year small, wingless Hymenoptera were found in a similar situation by Giard, who assumed that the females lie in wait for the laying of the egg-capsule, in order to oviposit in the eggs, and this was actually verified by Xambeu in 1881. Some years later a parasite was bred from the egg-capsule of *Mantis* and described under the name *Rielia manticida*, being none other than the parasite first discovered on the adult *Mantis* in 1877. Another Chalcid, *Priomerus insidiosus*, Coq., had also been observed by Bordage in Réunion to leave the underwings of a female *Mantis prasina*, to which it was adhering, and lay its eggs in the still frothy egg-capsule which the insect had just deposited.

WATTS (Dr. F.). **Work connected with Insect and Fungus Pests, and their Control.**—*Report Agric. Dept. St. Lucia for 1915–16, Barbados,* 15th August 1916, pp. 7–9.

The following is a list of the pests most commonly met with in St. Lucia :—*Diatraea saccharalis*) (moth borer) on sugar-cane; *Metamasius* (*Sphenophorus*) *sericeus* (weevil borer) on sugar-cane; *Diaprepes abbreviatus* (root borer) on sugar-cane; *Heliothrips rubrocinctus* (cacao thrips); *Lepidosaphes beckii* (purple scale) on limes and oranges, parasitised by *Sphaerostilbe coccophila* (red-headed fungus), and *Ophionectria coccicola* (white-headed fungus); *Coccus viridis* (green scale) on limes and oranges, parasitised by *Cephalosporium lecanii* (shield-scale fungus), as is also *Coccus mangiferae* (mango shield-scale) on mangoes; *Chionaspis citri* (snow scale) parasitised by *Myriangium duriaei* (black fungus); *Aspidiotus destructor* (coconut scale); and *Laphygma frugiperda* (corn-ear worm) on maize. *Scapteriscus didactylus*, Latr. (mole-cricket) has become a serious pest owing to the destruction of its natural enemy, the ground lizard, since the introduction of the mongoose. Steps are now being taken to control the latter, and to re-establish the ground lizard by frequent importations. *Polistes annularis*, the wasp known as "Jack Spaniard," has been successfully introduced to control a leaf-eating caterpillar similar to the cotton worm [*Alabama argillacea*], which ravages green dressing crops such as horse-beans.

MOORE (J. C.) & WATTS (F.). **Report on the Botanic Gardens and Experiment Stations. Pests and Diseases.**—*Report Agric. Dept. Grenada for 1915–16, Barbados,* 24th October 1916, pp. 12–14.

Polistes annularis, the wasp known as "Jack Spaniard," a useful and active enemy of caterpillars and other insects, was at one time plentiful in Grenada, but owing to its practical extinction it was reintroduced from St. Vincent. A much smaller wasp, *Polybia occidentalis* (known as the Marabunta), is common in Grenada.

WATTS (Dr. F.). **Work connected with Insect and Fungus Pests and their Control.**—*Report Agric. Dept. Montserrat for 1915–1916, Barbados,* 24th November 1916, pp. 23–26. [Received July 1917.],

Dysdercus delauneyi, Leth. (cotton stainer) is potentially a very serious pest of cotton in Montserrat, but fortunately attains its maximum in numbers and distribution from October to December,

after the main cotton crop has been reaped. After the compulsory destruction of the old cotton in January the insects survive on native plants, including the John Bull tree (*Thespesia populnea*), the silk-cotton tree (*Eriodendron anfractuosum*) and many shrubby and herbaceous Malvaceae, from which they migrate to the young cotton in July or August. No effective means of control is known, though the destruction of their native food-plants and diligent hand-picking should check them in the earlier part of the year.

WATTS (Dr. F.). **Experiments at the Botanic and Experiment Stations, and Special Entomological Investigations.**—*Rept. Agric. Dept. St. Vincent for 1915–1916, Barbados,* 11th December 1916, pp. 5–23.

Cotton was attacked by *Alabama argillacea* (cotton worm), *Eriophyes gossypii* (leaf blister mite), *Saissetia major* (black scale), *Colaspis fastidiosa* (bronze beetle) and the Tingid bug, *Corythuca* sp., but in a minor degree by all. Two new pests have been observed, a beetle, whose larva tunnels in the stem near the ground, and a thrips found attacking the leaves and bolls of both wild and cultivated cotton. Experimental investigations on *Dysdercus delauneyi* (cotton stainer) showed that no internal boll disease appeared in the absence of these insects. The following insects have been observed attacking cassava: *Cryptorhynchus* sp. (cassava borer), the control of which might be effected by disinfecting the cuttings and by instituting a close season to prevent young plants becoming infected from old ones; *Dactylopius* sp. (mealy-bug) which is controlled by the larva of an unidentified Syrphid fly, and the larva of an unidentified moth; it could also be controlled by a close season, the burning of affected stems, and the planting of only healthy stocks; a weevil, *Diaprepes spengleri*, for which no method of control has yet been attempted; *Erinnyis ello*, L. (cassava hawk-moth), of which only the eggs, parasitised by a small Hymenopteron, have hitherto been found; two species of thrips, *Corynothrips stenoptera* and *Frankliniella melanommatus*, for which no control has been attempted; *Cecidomyia manihot*, Felt (cassava gall-maggot), an insect which is extensively parasitised by two minute Hymenoptera, and which causes no particular damage; and finally, the cassava mite [*Tetranychus bimaculatus*]. The insect pests of maize are chiefly mole-crickets [*Scapteriscus didactylus*], which destroy 15–25 per cent. of the young plants, and for which no serious methods of control have been undertaken; *Laphygma frugiperda* (corn-worm) [see this *Review*, Ser. A, i, p. 517], which feeds on no plants except those capable of affording protection from the wasp *Polistes annularis*; *Diatraea saccharalis*, F. (lesser moth borer of sugar-cane), which can be controlled only during the egg-stage, the eggs being parasitised by *Prophanurus alecto* and by *Trichogramma minutum*; the insect prefers to lay eggs on maize, hence the importance of clearing away old maize stalks from the fields; *Heliothis obsoleta* (boll worm), which is held in check by *Trichogramma minutum*, an egg-parasite; and *Agromyza* sp. (leaf-miner) which is extensively parasitised by Chalcids. *Calpodes ethlius* (arrowroot worm) caused extensive defoliation, but was completely controlled, at first by three species of Tachinid flies, and later by an unidentified

egg-parasite. Lima beans were attacked by several important pests which have already been noticed [see this *Review*, Ser. A, iv, p. 42].

It is to be regretted that a parasite of the predaceous wasp, *Polistes annularis*, has made its appearance.

WATTS (Dr. F.). **Work connected with Insect and Fungus Pests and their Control.**—*Report Agric. Dept. St. Kitts-Nevis for 1915–16, Barbados*, 17th January 1917, pp. 11–12. [Received July 1917.]

Sugar-cane was remarkably free from insect attacks during the year, owing to favourable weather conditions, the only serious damage being that of grasshoppers, which were however efficiently controlled by poisoned bran mixture, composed of 25 lb. bran, 1 lb. Paris green, 2 quarts molasses, and the juice and skin of 4 sour oranges, which proved more effective than Criddle mixture. Cotton was damaged by cockroaches and field-crickets, and cotton-stainers, though not very prevalent, were responsible for the first appearance in the island of the internal boll rot of cotton, introduced by the insect when puncturing the young boll.

WATTS (Dr. F.). **Work connected with Insect and Fungous Pests and their Control.**—*Report Agric. Dept. Antigua for 1915–16, Barbados*, 30th January 1917, pp. 15–17. [Received July 1917.]

During the year considerable damage has been caused to sugar-cane by the larvae of the brown hard-back beetle (*Lachnosterna* sp.), but its parasite, the Scoliid wasp (*Tiphia parallela*) has been found for the first time in Antigua, where it now appears to be established. Their numbers may probably be increased by an improved supply of food-plants, such as maize, sorghum and okra, which are attacked by Aphids producing quantities of honey-dew, by which the *Tiphia* adults are attracted. The lightening of the soil by frequent tillage, and the addition of coarse organic manures or lime, would render more easy the entrance of the adult female *Tiphia* in search of grubs. Cotton plants were severely attacked by *Alabama argillacea* (cotton caterpillar), and to a less extent by *Dysdercus* sp. (cotton-stainer), *Heliothis obsoleta* (boll-worm), *Hemichionaspis minor* (white scale), and *Saissetia nigra* (black scale). Limes were again attacked by the weevil, *Exophthalmus esuriens*, which appeared during May and June, though not in such large numbers as last year, owing to the energetic control measures undertaken. The onion crop was attacked by *Prodenia* sp. (onion caterpillar), which was however quite efficaciously controlled by hand-picking, and also by *Thrips tabaci* and *Lachnosterna* grubs.

UVAROV (B. P.). **Къ борьбѣ съ саранчевыми на Сѣверномъ Кавказѣ.** [On the Control of Locusts in Northern Caucasia.]—**«Земледѣльческая Газета.»** [*Agricultural Gazette*], *Petrograd*, nos. 19–20, June 1917, p. 388.

A conference took place in March 1917 in Stavropol to discuss the permanent organisation of campaigns against locusts in Northern Caucasia. It was agreed that the success of the work demands the creation of a special "Anti-locust Bureau" in whose hands the whole

responsibility for the conduct of the campaign and of investigations as to the breeding places of the pests should be concentrated. The Bureau should be financed by pro-rata contributions from the local funds of all the provinces concerned, and should also receive grants from the Central Government. The author was entrusted with drawing up a full scheme for the organisation of such a Bureau to be presented to the next Conference.

TIMOFEIEV (S. N.). **Культура чайнаго куста и производство чая въ Западномъ Закавказьѣ.** [The Cultivation and Production of Tea in Eastern Transcaucasia.] — **«Русскіе Субтропики.»** [*Russian Subtropics*], *Batum*, x, no. 1–2, 1917, pp. 1–32.

The following local pests of the tea plant are mentioned: the tea mite [*Tetranychus bioculatus*]; a species of *Lecanium*, accompanied by the fungus *Meliola penzigi*, Sacc.; and caterpillars of a Tortricid (probably *Homona coffearia*). These insects rarely cause great damage and can be controlled by spraying with kerosene emulsion or with a solution of soft soap and Bordeaux mixture. The mole-cricket [*Gryllotalpa gryllotalpa*] also attacks young plants.

JATZENTKOVSKY (E. V.). **Изъ опытовъ по борьбѣ съ кровяной тлей въ Терской области.** [Experiments on the Control of *Eriosoma* (*Schizoneura*) *lanigerum*, Hausm., in the Province of Terek.]— **«Земледѣльческая Газета.»** [*Agricultural Gazette*], *Petrograd*, no. 42 (158), 28th October 1916, pp. 1101–1102. [Received 13th July 1917.]

The environs of Vladikavkaz, in the province of Terek, are heavily infested with *Eriosoma* (*Schizoneura*) *lanigerum*, and the author has been experimenting with a view to discovering an effective and easily made insecticide against this Aphid, *i.e.*, one that would destroy the waxy covering of the insect without affecting the trees and be at the same time inexpensive. The following insecticides were tried:—kerosene in water of a strength from 5 to 30%; 5–30% carbolineum in water; a mixture of both the above solutions at strengths of 5–10%; kerosene emulsion, containing 6 lb. kerosene and 1 lb. soft soap in 18–20 gallons of water; carbolineum emulsion, containing 3 lb. carbolineum and 4 lb. soap in 30 gallons of water; soft soap (1 lb. in 3 gallons of water); tobacco extract (1 lb. in 3 gallons of water); a mixture of equal volumes of the last two; carbol-tobacco emulsion (5 lb. tobacco extract, 2 lb. hard grey soap, 2 lb. crude carbol, in 30 gallons of water); quassia emulsion (5 lb. quassia and 6 lb. grey soap in 25 gallons of water); 1 per cent. lysol; and 1 per cent. oxalic acid. It appeared that oxalic acid, lysol and quassia are of no use; better results were obtained from soft soap, the effect of which however depended on the strength of impact of the spray, and from tobacco extract and kerosene; while quite good results were obtained from a mixture of tobacco extract and soap. Repeated experiments with these and other insecticides showed the following emulsions to be the most effective: (*a*) 1% of carbolineum and 4–5% of soft soap in water, which is regarded as the most useful; (*b*) 3% of wood-alcohol, 3% of turpentine, and 4–6% of soft soap in water; (*c*) 2% of turpentine, 2% of xylol, 2% of wood-alcohol, and 4% of soft soap in water, which

proved to be the most effective; (*d*) 10% of carbol and 10% of soft soap in water; (*e*) $1\frac{3}{4}$% of tobacco and 7% of soft soap in water, which however is troublesome to prepare properly and chokes the sprayer; (*f*) 2% of carbolineum and 2% of turpentine in water.

Kulagin (Prof. N.). **Къ вопросу о задачахъ центральнаго энтомологическаго бюро министерства земледѣлія.** [On the Question of the Aims of the Central Entomological Bureau of the Ministry of Agriculture.]—**« Земледѣльческая Газета.»** [*Agricultural Gazette*], *Petrograd*, no. 42 (158), 18th October 1916, pp. 1097–1098. [Received 13th July 1917.]

The existing Bureau of Entomology of the Scientific Committee of the Ministry of Agriculture is engaged chiefly in purely scientific research work on the biology and control of insect pests. The same kind of work is done also by the local Entomological Stations, the results achieved by the latter being even more valuable as being more in contact with local requirements, possibilities and conditions. The essential requirements of Applied Entomology in Russia necessitate the creation of a Central Entomological Enquiry Bureau, to reply to enquiries of local workers, to assist them in identifying insect pests and supply them periodically with reviews of the most important works in this branch.

Destruction of Ants.—*Revista Nac. de Agricultura, Bogotá,* November 1915. [Received 2nd July 1917.]

The following methods are recommended for dealing with ants. Quicklime or fire ashes may be poured on to the ant-hill, or a strong decoction of walnut leaves may be allowed to soak into the ant-hill and cover it. Damp rubbish may be burned over the ant-hills late in the afternoon. In order to prevent the ants reaching fruit trees, the base of the tree should be girdled round by a band about 2 ft. wide of liquid pitch covered with charcoal powder, or by a band of woven horse-hair. Bee-hives may be kept free from ants by surrounding them with fish scraps, or by putting around each a cord soaked in linseed oil to which some lamp-black has been added. Rooms and furniture can be kept immune by sprinkling with a solution of 10 grams of naphthaline in 50 grams of benzine. All cracks should be filled up with plaster of Paris or cement.

(Smith Longfield). **Control of** *Strategus* **Grubs.**—*Report Agric. Expt. Sta. in St. Croix for the Year 1914–1915, St. Croix,* pp. 24 & 30. [Received 2nd July 1917.]

The large white grub of the Dynastid beetle, *Strategus titanus,* is the most serious pest of sugar-cane in St. Croix. The control recommended is a poison-bait composed of 3 lb. Paris green mixed with water, and sprinkled on 100 lb. of fine megass by means of a watering-can until an intimate mixture is obtained. A small handful of this bait should be placed at intervals of about 3 feet in the banks containing the pen-manure, before covering with the plough. In badly infested fields the bait should also be placed in the cane-furrows.

As a precaution against moth-borer, infested cuttings of sugar-cane should be carefully avoided in planting. *Diaprepes farinosus* (root-borer) can be controlled by the use of sunflowers as a trap-crop. The weevils collect on the sunflower heads and can be readily collected and destroyed.

A new kerosene-soap emulsion which has been proved to be a very successful insecticide consists of $4\frac{1}{2}$ lb. whale-oil soap dissolved in $1\frac{3}{4}$ pints of fusel oil, using a wooden paddle to stir with until thoroughly dissolved, when 7 quarts of kerosene is added. One part of this mixture should be diluted with 9 or 10 parts water before use. As all the ingredients are insecticides the mixture is very effective, and it will keep indefinitely in the concentrated form and for a long time in diluted form.

Bentley (G. M.). **The Control of Injurious Insects and Plant Diseases in the U.S.A.**—*Univ. Tennessee Agric. Expt. Sta., Knoxville*, Bull. no. 117, March 1917, pp. 111–123, 1 fig. [Received 2nd July 1917.]

This is a new and revised edition of a former Bulletin which has previously been abstracted [see this *Review*, Ser. A, iii, p. 549].

Sanborn (C. E.). **The Alfalfa Web Worm.**—*Oklahoma Agric & Mechan. Coll. Agric. Expt. Sta., Stillwater*, Bull. no. 109, February 1916, 7 pp., 4 figs. [Received 2nd July 1917.]

Loxostege similalis, Guen. (alfalfa web-worm) hibernates in Oklahoma in the pupal stage, the adults appearing about mid-April; five successive generations follow, the last being present as late as November. The natural food-plants are the "careless" or pig weeds, and almost all common weeds found in the State, but the moths oviposit on practically all farm and garden crops, except small grains such as wheat and oats. The eggs are laid in masses on the lower side of the leaves and hatch within three or four days, the larva spinning a web across the upper side of the leaf, under which it is protected and concealed. The earlier generations pupate under this web, but the larvae of the last generation, when mature, burrow into the soil to a depth of about one inch, where they spin a web to form a pupal cell, in which hibernation takes place. The adult moths do not fly far. Lucerne fields which are threatened with a serious infestation should be mowed and made into hay as soon as possible, as the caterpillars neither develop on nor injure dry hay. Lucerne that is being grown for seed should be sprayed with Paris green, $1\frac{1}{2}$ lb. being used with 5 lb. air-slaked lime to each acre. Powdered lead arsenate can be substituted for Paris green for crops such as cotton or young maize. In the autumn lucerne fields should be cultivated so as to render the soil readily pervious to water, for the ensuing frosts will then destroy all the insects hibernating in it. As the caterpillars feed largely on weeds, clean cultivation is necessary wherever possible.

The synonymy of the species is given and a bibliography of 21 works.

Sanborn (C. E.) & Painter (H. R.). **The Locust Borer** (*Cyllene robiniae*, **Forst.**)—*Oklahoma Agric. & Mecham. Coll. Agric. Expt. Sta., Stillwater*, Bull. no. 113, March 1917, 8 pp., 4 figs.

In Oklahoma, where locust trees are grown for posts as well as for shade, the growing of first-class trees is a difficult problem owing to the damage done by the locust borer. The adult beetles appear about the middle of September and feed on the pollen of flowers, particularly of the common golden-rod. They are active during the warmer part of the day, descending to the ground for the night. Eggs are placed in crevices in the bark, or in an old wound, and hatch in 6 or 7 days. The young larva bores through the bark and tunnels in the wood until the weather becomes cold, when it ceases its activities and remains dormant throughout the winter. During the autumn, the presence of larvae can often be detected by small moist spots on the bark and small masses of sawdust pushed out by young borers through the opening of their tunnels. In the spring the larvae again become active and burrow deeper into the tree, often penetrating the heartwood. They reach maturity about mid-August, when pupation takes place in the tunnel and lasts 10 to 14 days. Adults sometimes remain in the tunnels for some time before emerging. Dead larvae found in tunnels appear to have been attacked by some disease, but no definite conclusions have been reached in this respect. The wheelbug, *Prionidus cristatus*, feeds on the adults, but is not effectual in controlling an infestation. The pest can be reduced to a marked extent by the destruction of all golden-rod in the vicinity ; but as this is a very good honey plant, the method is objectionable where bees are kept. A coating of whitewash applied to the trunk and main branches during late summer will check oviposition. All cracks and crevices in the bark should be filled with the mixture. Tanglefoot is ineffective in capturing the beetles.

A bibliography of 24 works is given.

Painter (H. R.). **The San José Scale.**—*Oklahoma Agric. & Mechan. Coll. Agric. Expt. Sta., Stillwater*, Circular no. 41, April 1916, 7 pp., 3 figs.

Aspidiotus perniciosus, Comst., was first recorded in Oklahoma in 1904, the insects being active from the commencement of spring growth of the trees until November. The life-history of the scale, probable means of distribution and the usual methods of control are discussed. Stringent laws relative to the importation of infested stock are in force. When young trees are being transplanted it is advisable to dip them in the lime-sulphur solution used for spraying, the roots only not being immersed. Lady-birds and other insect parasites, as well as fungus diseases, effectively check the increase of the scale.

Protection of Crops.—*Canada Dept. of Agric., Ottawa*, Crop Protection Leaflet, no. 1, May 1917.

This Government leaflet calls attention to the fact that Canada loses over one hundred million dollars worth of staple crops every year through the depredations of insect pests. The Department of Agriculture urges the necessity of reporting insect outbreaks or of

sending enquiries immediately any damage is observed, in order that control measures may be undertaken without delay. Clean farming, the securing of vigorous growth in young plants and good cultivation are recommended as the best protective measures against insect attack.

SWAINE (J. M.). **Canadian Bark-Beetles. Part I. Descriptions of New Species.**—*Canada Dept. Agric., Ottawa,* Bull. no. 14, February 1917, 32 pp. [Received 2nd July 1917.]

This is the first of a short series of bulletins on the species of bark-beetles found in Canada, with their life-histories and bionomics. The beetles constitute the chief insect enemies of the Coniferous trees in the Canadian forests and cause enormous losses by their depredations. The species described in this bulletin include 39 new species, and two new genera are erected.

ILLINGWORTH (J. F.). **Notes on Life-History of** *Attagenus plebejus,* **Sharp.**—*Proc. Hawaiian Entom. Soc., Honolulu,* iii, 4, May 1917, pp. 287–288.

This destructive household beetle [*Attagenus gloriosae,* F.] does not seem to occur outside the Hawaiian islands. Newly emerged adults were confined in a covered glass dish for 36 days before the first eggs and newly hatched larvae were discovered. The larval period consists of seven instars and the pupal stage lasts 12 to 14 days, the whole life-cycle occupying about 150 to 160 days. Carbon bisulphide destroys the insects, but a second treatment is found necessary, indicating the probability that the eggs are not destroyed by this method.

ILLINGWORTH (J. F.). **Webbing Clothes Moth predaceous.**—*Proc. Hawaiian Entom. Soc. Honolulu,* iii, no. 4, May 1917, p. 274.

Larvae of *Tineola biselliella,* Hummel, having been taken from brushes, upon which they had fed, were placed in a test-tube with bits of tissue paper so that they might pupate. Several cocoons with almost mature pupae were put in with them. The larvae, being without food, dug into these cocoons in the night and ate the living pupae before spinning their own cocoons.

ILLINGWORTH (J. F.). **Economic Aspects of our predaceous Ant** (*Pheidole megacephala*).—*Proc. Hawaiian Entom. Soc., Honolulu,* iii, no. 4, May 1917, pp. 349–368, 1 plate.

In spite of the popular notion that ants are noxious insects, the author agrees with several leading students of the subject in considering that as a group they are eminently beneficial, not only in the removal of myriads of dead insects, but also as an important factor in the destruction of the living. A large colony is estimated to collect some 100,000 insects daily during their greatest activity. The worst enemies of ants are other species of ants, and it is frequently

found, especially in the Tropics, that one species becomes dominant in a certain region at the expense of all others. The Argentine ant (*Iridomyrmex humilis*) has entirely supplanted *Pheidole megacephala* in Madeira, and is similarly displacing all other ants in the Southern States of America, while *Pheidole megacephala* in turn displaced other species such as *Prenolepis longicornis* and *Solenopsis geminata* var. *rufa* in certain districts in Hawaii. In the humid valleys *P. megacephala* is exceedingly abundant ; during heavy rains, however, the ants suffer severe losses, and it is at this time that they attack unprotected apiaries, swarming into the hives in such numbers as to destroy the bees or drive them away. The best protection against their depredations is to support the corners of the hive on spikes coated with axle-grease, to which the ants have a great aversion. Unfortunately their attacks upon insects include beneficial as well as harmful species, and parasitic flies which have been liberated and have appeared to have established themselves during the rainy season will sometimes entirely disappear during the dry season, when *P. megacephala* is abundant. In Hawaii the species is not sufficiently numerous to counteract the increase of the liberated flies. While ants are frequently regarded as noxious owing to their relation to Aphids, Coccids and leaf-hoppers, it must be remembered that they frequently devour these insects, especially when there is a shortage of honey-dew. They have also been recorded as destroying cochineal insects and eating some of the mealy-bugs on sugar-cane. By removing the sweet excretions produced by various bugs upon the leaves they check the growth of destructive leaf-fungi. As a household pest this species is of no great importance, as food can easily be protected from them. A case is recorded of some fish infested with Dermestid larvae, in which ants cleared out all the larvae within two days, leaving the fish untouched. In their activities against household flies they render valuable service ; while in the field they attack many of the most destructive pests, including the powerful Hawaiian mole-cricket (*Gryllotalpa africana*). In Cuba another mole-cricket [*Scapteriscus didactylus*] is said to have become quite scarce owing to its destruction by ants. In Fiji, almost every insect collected at lights by the author had a number of ants attached to it. The June beetles (*Rhopaea* sp.), which destroy large areas of sugar-cane by feeding upon the roots, are vigorously attacked by the ants, many of which cling to a single specimen. As a control for ants in houses, a lamp-wick dipped in bichloride of mercury, then dried and pinned round the legs of furniture, is recommended ; or sodium fluoride dusted in places frequented by ants causes them to disappear.

An annotated bibliography of 22 works is given.

SEN (P. C.). *Alcides frenatus*, **a Coleopteron Injurious to the Mango Tree in Bengal.**—*Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, viii, no. 2, February 1917, pp. 315–316. (Abstract from *Agric. Dept., Bengal*, Leaflet no. 2 of 1916.)

Alcides frenatus, Fst. (mango-shoot weevil) causes severe injury to mango-trees, the larvae boring galleries in the new shoots. Any shoots containing eggs or larvae should be destroyed.

Jablonowski (J.). **Scale Insects as Vine Pests and their Relationships with other Cultivated Plants.**—*Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, viii, no. 2, February, 1917, pp. 316–317. (Abstract from *Kisérletügyi Közleményck, Budapest*, xix, no. 2, 1916, pp. 169–288, 31 figs.).

The Coccids of the vine are mostly occasional pests which have spread from some adjacent food-plant. The vineyards in Hungary are now rapidly developing in the direction of the *Robinia* plantations, where the Coccid *Eulecanium corni*, Bch., var. *robiniarum*, Dougl., is numerous and is already beginning to appear on the vines. The following six species of scale-insects have been recorded on the vine, some of them having already appeared in Hungarian vineyards: *Phenacoccus aceris*, Sign., rarely seen on vines, is common in Hungary upon maples, wild chestnut, and fruit trees, especially apple; *Pseudococcus adonidum*, L. (*P. longispinus*, Targ.), has not been found as a field pest of vines, but attacks conservatory and hot-house plants; *Pseudococcus citri*, Risso (*P. brevispinus*, Targ.), is indigenous to Hungary, but is not an exclusive pest of the vine, and does no injury to that host; *Pulvinaria betulae*, L., is often found in quantities on long-pruned vine canes; *Eulecanium corni* var. *robiniarum*, Dougl., infests Robinias throughout Hungary, and during autumn and spring migrations may reach vines or other plants; *Eulecanium persicae* may reach the vine in a similar manner. The more old wood present on the vines, the more the scales are likely to increase. The two last-named species retard the formation of spring shoots.

The best natural means of control is short pruning of the vines annually. The large female scales should be crushed immediately after egg-laying. Spraying is rendered difficult owing to the impossibility of reaching all the insects, while the liquids hitherto used (carbolineum, strong petroleum emulsions) are harmful to the canes in winter, sometimes even fatal.

Garman (H.). **The Locust Borer** (*Cyllene robiniae*) **and other Insect Enemies of the Black Locust.**—*Kentucky Agric. Expt. Sta., Lexington*, Bull. no. 200, January 1916, pp. 99–135, 23 figs.

Most of the information contained in this bulletin concerning the locust borer has already been abstracted from another source [see this *Review*, Ser. A, v, p. 398]. As a control, the author recommends spraying with one part concentrated manufactured lime-sulphur to eight parts water after the grubs have penetrated the bark.

Other insects infesting the wood of locust trees include *Prionoxystus robiniae* (the carpenter moth), *Ecdytolopha insiticiana* (locust twig-miner) and the beetle, *Agrilus egenus*. The leaves are damaged by *Chalepus dorsalis*, a black and yellow Hispid, which mines between the two cuticles of the leaves, *C. nervosa*, and a number of moths which mine or skeletonise the leaves, including *Gracilaria lespedezifoliella*, *Phyllorycter* (*Lithocolletis*) *ostensackenella*, *P. robiniella*, *Gelechia pseudacaciella*, and *Eudamus tityrus*. Fourteen species of puncturing insects which suck the sap from the leaves or young twigs are also mentioned.

Brittain (W. H.) & Saunders (L. G.). **Notes on the Black Apple Leaf-Hopper** (*Idiocerus fitchi*, **Van D.**).—*Canadian Entomologist, London*, xlix, no. 5, May 1917.

This paper gives a systematic description of the life-stages of *Idiocerus fitchi*, Van D. (black apple leaf-hopper), which is of little importance as a fruit pest, having been taken on thorn bushes and crab-apples, though in Nova Scotia it swarms on pears and apples in spring and early summer. There is only one brood a year, the winter being spent in the egg-stage.

Smit (C. W. H.). **Note on the Feeding Habits of a Ladybird Larva.**—*S. Afr. Jl. Science, Cape Town*, xiii, no. 7, Febrnary 1917, pp. 302–306.

Observations on the feeding habits of *Scymnus casstromi*, Muls., which attacks the potato aphis, are recorded in this paper. The ladybird larva, having seized the aphis, injects a small amount of green fluid into the body of its victim, which in about three minutes is seen to flow back towards the larva. Thereafter, a steady flow of liquid is maintained from and to the larva, the amount increasing until the aphis is alternately drained to translucency and engorged almost to bursting. At each successive injection the fluid obviously contains a larger proportion of the larva's digestive juices, until finally the aphis is sucked dry. As many as 50 regurgitations have been counted in the process, the duration of the meal in this case being 1 hr. 3 mins. Another species of ladybird, *Hyperaspis hottentota*, has been observed to have similar feeding habits.

Criddle (N.). **The American Crow in Relation to Agriculture.**—*Agric. Gazette of Canada, Ottawa*, iv, no. 6, June 1917, pp. 446–450.

The crow is generally condemned as a destroyer of eggs and young of domestic and wild birds and a devourer of grain. The author suggests however that there is probably a balance of usefulness from the farmer's point of view in the crow's favour. While grain is undoubtedly eaten in autumn when other food is scarce, this is very often gathered from burnt stubble-fields. In the destruction of noxious pests the crow is undoubtedly an important factor, constantly following the plough, cultivator or harrow and clearing up the larvae of cutworms, wireworms and white grubs that are exposed, the latter being reduced in some cases by more than 50 per cent. by the crows, while other means of destroying them are almost impossible. Army-worm and locust infestations have often been largely checked by the attacks of crows, which prove their usefulness also by killing mice and removing carrion.

J. F. **The Beet Fly.** —*Gardeners' Chronicle, London*, no. 1593, th July 1917, p. 4.

Pegomyia hyoscyami (*Anthomyia betae*) has proved more troublesome this year than in any other year within memory. The method of squeezing the leaves to kill the larvae is so efficacious that it is the only one adopted by some growers. However, dusting the

plants while damp with soot or powdered lime, or spraying the leaves with strongly-smelling tobacco water or with X.L.All liquid insecticide, also gives good results.

TALBERT (T. J.). **Control of Some of the Important Garden and Truck Crop Insects.**—*Missouri Agric. Expt. Sta., Columbia,* Circular no. 15, April 1917, 24 pp., 19 figs. [Received 10th July 1917.]

This paper reviews the chief vegetable pests of Missouri, and gives formulae for contact sprays for sucking insects and poison-bait for chewing and biting insects. Spray-outfits for liquid and dust sprays are described, and a spraying calendar is included. The paper contains no new information.

HASEMAN (L.). **The Periodical Cicada in Missouri.**—*Missouri Agric. Expt. Sta , Columbia,* Bulletin no. 137, November 1915, 33 pp., 19 figs. [Received 10th July 1917.]

This report was prepared in response to numerous requests of farmers and fruit-growers for information concerning the periodical cicada [*Tibicen septemdecim*]. Much of the information contained in the bulletin has already been abstracted [see this *Review*, Ser. A, ii, p. 433]. Experiments to determine the effect of climate on the two distinct races (the 13–year and the 17-year) gave indeterminate results, but obviously climatic conditions are not sufficient to account for the fact that in the same field it requires 17 years for the one race to develop and only 13 for the other. In Missouri, there are four broods of each race ; these are classified and their origin and distribution discussed. The broods consist of two forms, the larger form being the more abundant. The dwarfed form was formerly described as a distinct species, *Cicada cassinii*, but is now considered as a variety of the periodical cicada. The favourite hosts are oak, apple, hickory, ash and walnut trees, and sometimes vines and herbaceous plants. The injury is done to the twigs, those in which eggs are deposited being weakened or killed. The eggs are laid in June in nests dug into the wood, the female dying after depositing her supply of eggs. The young larva, which hatches after six or seven weeks, very soon drops to the ground and enters upon its subterranean life. Experiments conducted throughout the entire 17-year life-cycle revealed the fact that six stages are passed underground, the first four being larval and the last two nymphal periods, each stage being characterised by structural differences. The cell of the young larva is usually formed along the side of a small root, which constitutes its principal food supply, but so little food is required each season that practically no injury is done to the tree by the larvae. The nymph in its last stage digs its way to the surface of the ground and ascends the nearest tree, the adult emerging about the end of May.

Natural enemies include, besides insectivorous birds and mammals, small wasps, flies and mites, which feed upon the eggs and destroy them in great numbers. *Sphecius speciosus*, a large digger-wasp, kills the adults and stores them away in burrows as food for its young. Dragon-flies have also been known to attack the adults. Common whitewash or Bordeaux mixture will effectually prevent the deposition of eggs.

Cory (E. N.). **Entomological Investigations.**—*Twenty-ninth Ann. Rept., for the Year ending 30th June 1915, Maryland Agric. Expt. Sta., College Park, Md.*, pp. 8–9. [Received 10th July 1917.]

Leaf-miner pests included :—*Phytomyza aquilegiae*, eggs of which are deposited in early June on the lower side of the leaves of Aquilegias. Larvae of the first brood remain and pupate on the leaves. Pupae of the second generation hibernate in the ground. A species of *Sympiesis* was found to be parasitic on this leaf-miner. Control recommended is the eradication of weeds. The boxwood leaf-miner [*Monarthropalpus buxi*] caused considerable injury in certain districts and is being studied with a view to control. Holly trees were injured by a new leaf-miner.

Leidigh (A. H.), McNess (G. T.) & Laude (H. H.). **Japanese Sugar-Cane as a Forage Crop.**—*Texas Agric. Expt. Sta., College Station, Texas*, Bull. no. 195, August 1916, 28 pp., 7 figs. [Received 10th July 1917.]

The insect enemies of Japanese sugar-cane in Texas are not numerous, and the damage caused by them has not as yet been serious. The principal pest is *Diatraea saccharalis* (cane moth borer), the larvae of which bore into the stalks of the cane, reducing the juices of the plant. Preventive measures recommended are the burning, or, better, the ploughing under of old cane-stalks and leaves from infested fields. Johnson grass and old maize stalks should also be destroyed near cane-fields as the moth borer apparently attacks these crops also. The common chinch bug [*Blissus leucoptera*], which is very prevalent in Central Texas, does considerable damage to sugar-cane in dry, hot weather.

Rohwer (S. A.). **Descriptions of Thirty-one new Species of Hymenoptera.**—Separate, dated 5th June 1917, from *Proc. U.S. Nat. Mus., Washington*, vol. 53, pp. 151–176, no. 2195.

The species described include seven sawflies, the remainder being mostly parasites, comprising :—Ichneumonidae : *Pyracmon conocola*, a parasite of *Pinipestis* in the cones of *Pinus coulteri* ; *Meleborus laspeyresiae*, from *Laspeyresia toruta* in the cones of *Pinus ponderosa* ; *Phadroctonus argyresthiae*, from an *Argyresthia* on *Libocedrus decurrens*. Braconidae : *Cosmophorus pityophthori*, from a *Pityophthorus* in twigs of *Pinus tuberculata* ; *Diospilus neoclyti*, from *Neoclytus caprae* ; and *Phanerotoma erythrocephala*, from *Laspeyresia toruta*.

Gahan (A. B.). **Descriptions of Some New Parasitic Hymenoptera.**—Separate, dated 26th May 1917, from *Proc. U.S. Nat. Mus., Washington*, vol. 53, pp. 195–217, no. 2197. [Received 10th July 1917.]

The following are among the new species described :—Braconidae : *Ephedrus nitidus*, from *Aphis brassicae* in New Jersey ; *Microbracon sanninoideae*, from *Aegeria* (*Sanninoidea*) *exitiosa* in Maryland ; *Apanteles diacrisiae*, from larvae of *Diacrisia virginica* in Washington, D.C. ; *Chelonus phthorimaeae*, from *Phthorimaea operculella* in Colorado ; *Phanerotoma frankini*, from the larva of *Mineola vaccinii* (cranberry fruit worm) in Massachusetts ; *Opius*

pegomyiae, from pupae of *Pegomyia vicina* in California; *O. otiosus*, from pupae of *Agromyza parvicornis* in Texas; *Neopius* (gen. n.) *carinaticeps*, from *Agromyza* sp. in North Dakota; *Rhogas perplexus*, from larvae of *Lycophotia* (*Peridroma*) *margaritosa* in Arizona; *R. politiceps*, from *L.* (*P.*) *incivis* in Tennessee; *R. rufocoxalis*, from *Phytometra brassicae* and *L.* (*P.*) *margaritosa* in Colorado. ICHNEUMONIDAE: *Nepeira benevola*, Gahan, var. *fuscifemora*, n., from *Phthorimaea operculella* in California. CHALCIDIDAE: *Liodontomerus secundus*, an external parasite of larvae of *Bruchophagus funebris* in Ohio; *L. insuetus*, reared from seed infested with *B. funebris* and probably parasitic on that host, in Arizona; *Systellogaster* (gen. n.) *ovivora*, reared from egg-cases of *Blatta orientalis* in Illinois; *Pteromalus hemileucae*, from pupae of *Hemileuca oliviae* in New Mexico; *Eupteromalus tachinae*, from the puparium of a Tachinid parasite of *Cirphis unipuncta*, probably *Archytes analis*, in Tennessee; *Eutelus bruchophagi*, from *Bruchophagus funebris* in Utah; *Chrysocharus mallochi*, from *Agromyza felti* in Illinois; *Derostenus pallipes*, from *Phytomyza aquilegiae* in Maryland; *Tetrastichus dolosus* from *Euplectrus platyhypenae*, parasitising *Laphygma frugiperda*, and from *E. comstocki*, parasitising *Caradrina* sp. in Louisiana.

MYERS (P. R.). **A New American Parasite of the Hessian Fly** (*Mayetiola destructor*, **Say**).—Separate, dated 28th May 1917, from *Proc. U. S. Nat. Mus., Washington*, vol. 53, pp. 255–257, no. 2204. [Received 10th July 1917.]

Many specimens of a new Proctotrupid, *Polygnotus vernalis*, which is described in this paper, were reared from Hessian fly puparia collected during the summer of 1915 from various localities in Pennsylvania and Virginia. The author considers that this parasite may prove to be identical with *Platygaster zosine*, Wlk.

ROHWER (S. A.) & FAGAN (M. M.). **The Type-Species of the Genera of the Cynipoidea or the Gall Wasps and Parasitic Cynipoids.**—Separate, dated 6th June 1917, from *Proc. U. S. Nat. Mus., Washington*, vol. 53, pp. 357–380, no. 2208.

This paper contains an alphabetical catalogue of the 255 genera of the Cynipoidea with the type species of each genus.

HEADLEE (T. J.). **The 1916 Tests of Sulphur–Arsenical Dusts against the Strawberry Weevil.**—*New Jersey Agric. Expt. Sta., New Brunswick*, Circular 65, 7th March 1917, 7 pp. [Received 10th July 1917.]

The information contained in this paper has previously been abstracted from another source [see this *Review*, Ser. A, v, p. 287.]

PADDOCK (F. B.). **The Texas Foul Brood Law and Foul Brood Regulations.**—*Texas Agric. Expt. Sta., College Station*, Circular no. 17, November 1916, 20 pp. [Received 10th July 1917].

The text is quoted of the Texas Foul Brood Law of 1914. Under the enactments of this law the State Entomologist has adopted certain regulations applicable to various counties of Texas, whereby the work

of foul-brood eradication may be facilitated. These regulations provide that honey bees shall be kept only in movable frame hives permitting of ready examination. Bees kept in any other form of hive are subject to destruction by the county inspector at the owner's expense. County quarantines provide that no bees, honey, appliances or other things capable of transmitting foul-brood shall be moved or shipped into the counties under quarantine unless accompanied by the health certificate of the County Apiary Inspector of the county whence the material capable of transmitting the disease is moved, or, if there is no county inspector in the county whence these originate, inspection must take place immediately upon their arrival at their destination.

Morrill (A. W.). **Cotton Pests in the Arid and Semi-arid Southwest.** —*Jl. Econ. Entom., Concord, N.H.*, **x**, no. 3, June 1917, pp. 307–317.

This paper reviews the more destructive insect enemies of cotton in the south-western States, with special reference to their geographical distribution. The species dealt with include:—Hemiptera: *Chlorochroa ligata*, *Euschistus impictiventris*, *Dysdercus albidiventris* (cotton-stainer), *Euryophthalmus* (*Largus*) *succinctus*, *Leptoglossus zonatus* (leaf-footed plant bug), *L. phyllopus*, *L. oppositus*, and *Lygus pratensis* (tarnished plant bug), and its varieties. Orthoptera: *Melanoplus differentialis*, *Schistocerca vega* and *S. shoshone*. Lepidoptera: *Heliothis obsoleta* (cotton bollworm), *Alabama argillacea* (cotton leaf-worm), *Estigmene acraea* (salt-marsh caterpillar), *Prodenia ornithogalli* (cotton boll cutworm), *Hyphantria cunea* (fall webworm), *Euxoa* (*Chorizagrotis*) *agrestis* (western army cutworm), *Bucculatrix thurberiella* (cotton leaf-perforator), and an undetermined bollworm which attacks the bolls of Arizona wild cotton. Coleoptera: *Anthonomus grandis* (Mexican cotton-boll weevil), and *A. grandis thurberiae*. Homoptera: *Aphis gossypii* (cotton aphis), and a species of Aleurodid. Thysanoptera: *Heliothrips fasciatus* (bean thrips), and occasionally *Microthrips piercei*. Acarina: *Tetranychus bimaculatus* (two-spotted mite) and *Eriophyes thurberiae* (wild cotton blister mite).

A comparison is made between conditions in the arid south-west, whence 23 injurious species are recorded, and the States east of the 98th meridian, where 42 insect pests of cotton are found. Since the introduction of the pink bollworm (*Pectinophora gossypiella*) into northern Mexico, the North American continent is faced with the most serious menace to the cotton industry that has ever appeared.

A bibliography of 23 works is given.

Severin (H. H. P.). **Mediterranean Fruit-fly** (*Ceratitis capitata*, **Wied.) breeds in Bananas.**—*Jl. Econ. Entom., Concord, N.H.*, **x**, no. 3, June 1917, pp. 318–321.

As some doubt had been expressed as to the accuracy of a statement previously made by the author, namely, that the fruit-fly had been bred from bananas, the present paper has been written for the purpose of establishing definitely the fact that *Ceratitis capitata* can be bred from bananas under field conditions, and that this has been done by various observers on more than one occasion. The author adds that in the Hawaiian Islands certain varieties of bananas are not immune from the attacks of the Mediterranean fruit-fly under natural conditions.

Ferris (G. F.). Methods for the Study of Mealy-bugs.—*Jl. Econ. Entom., Concord, N.H.*, x, no. 3, June 1917, pp. 321–325.

The author criticises the method hitherto practised for the identification of mealy-bugs, namely, the measurement of the relative lengths of the segments of the antennae, which, he contends, are so variable as to render the method useless. A second factor which has hitherto been conducive to error is the lack of a satisfactory technique for the preparations of specimens for study. A method of staining these with magenta red in such a manner as to accentuate the characters that are of especial importance is advocated. The specimens are boiled in caustic potash and then the body contents washed out, after which they may be transferred directly to the stain, remaining for six hours. They are then removed into 95 per cent. alcohol in which the excess stain is washed out, placed for a moment in carbol-xylene and mounted in balsam. It is probable that a much more satisfactory basis for generic groupings can be found in counting the number of pairs of cerrari, or groups of pores and differentiated spines that occur on the margin of the body.

Burke (H. E.). Notes on Some Western Buprestidae.—*Jl. Econ. Entom., Concord, N.H.*, x, no. 3, June 1917, pp. 325–332.

This paper contains further notes on the life-histories and food-plants of numerous species of flat-headed borers in the western States [see this *Review*, Ser. A, v, p. 166]. A list of forty-four species is given, with the host-plants and injury to each. These investigations have revealed the fact that the adults of some of the most injurious species feed on the foliage of the host-plant, where they may be controlled by poison-sprays; while eggs are laid upon the bark, where they can be reached by contact-sprays. These methods, though perhaps not sufficient in themselves, will obviate the necessity for the wholesale burning and cutting out of infested parts, which has been previously recommended, and perhaps also render unnecessary the protection of the plant by repellent washes or protective covering. For example, *Agrilus politus*, which causes severe damage to alder and willow, feeds on the foliage in the adult stage and oviposits on the smooth bark of the limbs and main trunk. Arsenic sprays on the foliage should kill the adults, and oil or sulphur sprays should destroy the eggs on the bark. *Chrysobothris mali*, a destructive enemy of shade and fruit trees, might be controlled by the same methods.

Lovett (A. L.). Nicotine Sulphate as a Poison for Insects.—*Jl. Econ. Entom., Concord, N.H.*, x, no. 3, June 1917, pp. 333–337.

Nicotine sulphate is a very powerful repellent for caterpillars. When feeding takes place on foliage sprayed with the poison, the action of the nicotine is rapid and sure, causing death within a short time. The probable explanation of the actual cause of death has been discussed in a previous paper [see this *Review*, Ser. A, v, p. 21]. Experiments with nicotine sulphate in the control of *Cydia pomonella* (codling moth) gave unsatisfactory results. A table is given showing the result of treatment with various materials. Nicotine sulphate 1–400 gave

approximately one-half control. The best control was by Niagara dust sulphur, 85 per cent., plus Corona lead arsenate, 15 per cent., in the form of a dust application. This material was also found to check apple scab to a fair degree.

GILLETTE (C. P.) & BRAGG (L. C.). **The Migratory Habits of** ***Myzus ribis*** **(L.).**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 3, June 1917, pp. 338–340, 1 fig.

Myzus ribis is commonly found upon the leaves of various species of *Ribes*, especially upon the red currant, and is also known to attack the leaves of European black currant, Rocky Mountain wild currant (*R. aureum*), and occasionally the gooseberry. It is known to migrate from currant bushes in the middle of summer, but the alternate hosts have not been determined. *Myzus galeopsidis* has been found on *Stachys* as a summer host in Colorado, and a similar louse was taken upon *Lamium* and *Stachys* by Van der Goot, who thought the species might be identical with *M. ribis*, but was doubtful, as his attempts to transfer early summer forms to *Lamium* did not succeed. The authors of the present paper have repeatedly transferred the migrants from *Ribes* to *Stachys* and *Leonurus*, and the autumn migrants from these plants to the currant; they therefore assume that these two genera at least can be accepted as summer hosts of *Myzus ribis*, L.

LOVETT (A. L.) & ROBINSON (R. H.). **Arsenic as an Insecticide.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 3, June 1917, pp. 345–348.

A series of experiments are described in which an endeavour was made to find some inert material, easily obtainable in considerable quantities at reasonable cost, which would absorb sufficient arsenic from an arsenical solution to make the substance efficient as a spray, and which would thus reduce the cost of arsenical sprays. For these investigations, lamp-black and fuller's earth were used as absorbents of arsenic from a water solution of arsenic acid. Tables are given showing the killing efficiency of the various mixtures, the strength of materials used and the resultant degree of burning. Lamp-black proved impracticable under field conditions, the black colour apparently increasing the degree of burning owing to absorbing heat. Mixtures having fuller's earth as an absorbent caused comparatively little burning, while equal dilutions of arsenic without any absorbent burned up all the foliage. The results of one season's observations, both as to toxicity for insects and as to amount of burning, indicate that there are possibilities in the use of absorbents with arsenic, and further trials are planned on a larger scale for the coming season. If such a material is found adaptable to commercial uses, it should reduce the cost of arsenical sprays by about two-fifths.

DAVIDSON (W. M.). **The Reddish-brown Plum Aphis** (*Rhopalosiphum nympheae*, **L.**).—*Jl. Econ. Entom., Concord, N.H.*, x, no. 3, June 1917, pp. 350–353, 1 fig.

Rhopalosiphum nympheae, L., is widely distributed in the plum and prune districts of California, but is generally confined to a few trees in an orchard, so that the injury caused is at present negligible. The

stem-mothers hatch from winter eggs about the middle of February, and mature about the time of full bloom. The second generation of Aphids matures about the beginning of April. The spring forms feed on the tender stems and later on the leaf and fruit petioles. Winged forms appear during the second week in April and are found until July. These migrate for the summer to various water-plants, such as *Polygonum*, *Typha*, *Nymphea* (water lily), *Potamogeton* (pond weed), and *Alisma* (water plantain). Towards the end of October, autumn migrants appear on the winter host, feeding on twigs and petioles. After a development period of about 20 days, pairing takes place and winter eggs are deposited in the axils of the buds of the following year. As the stem-mothers hatch so early and feed at exposed points, control should not be difficult should the species become of sufficient economic importance. A description is given of the characteristics by which the species may be recognized and a table shows the comparative measurements of the various forms.

COLEMAN (G. A.). **The Development of the Motion Picture and its Place in Educational Work.**—*Jl. Econ. Entom. Concord, N.H.*, x, no. **3**, June 1917, pp. 371–373.

The value of the motion picture to the economic entomologist as an educational factor is pointed out in this paper. By means of the X-ray and the microscope, in connection with the motion picture camera, the external and internal anatomy of every living thing can be photographed and all muscular and other movements of animal and plant life can be recorded and reproduced. The value of motion introduced into a classroom lecture is obvious, while all lines of scientific investigation and farm and orchard management can be brought before the general public by means of a motor-driven machine and a few hundred thousand feet of film.

QUAYLE (H. J.). **Some Comparisons of** *Coccus citricola* **and** *C. hesperidum*.—*Jl. Econ. Entom., Concord, N.H.*, x, no. 3, June 1917, pp. 373–376.

This paper points out the differences between *Coccus citricola* and *C. hesperidum*, which in former years have frequently been confused. Besides the morphological differences, the life-histories and habits of the two species are markedly different. *C. citricola* has but one generation in a year, while *C. hesperidum* has three or four over-lapping generations. From August to March all living individuals of the former species are of one size, while there are two distinct sizes of the latter. *C. citricola* is oviparous, while *C. hesperidum* is ovoviviparous. The host-plants of *C. hesperidum* cover a wide range ; those of *C. citricola* include all varieties of Citrus, *Celtis occidentalis* (hackberry), *Rhamnus crocea* (buckthorn), *Punica granatum* (pomegranate), *Solanum douglassi* (night-shade), *Juglans regia* (English walnut), and *Ulmus americana* (elm). Parasites reared from both species of *Coccus* include *Coccophagus lecanii*, *C. lunulatus*, and *Aphycus luteolus*. *Microterys flavus* is parasitic upon *hesperidum*, but apparently not upon *citricola* ; the opposite is the case with *Coccophagus flavoscutellum*.

Howard (L. O.). **How the Bureau of Entomology is meeting the Great Issue.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 3, June 1917, p. 377.

Immediately upon the declaration of War a letter was transmitted from the Chief of the Bureau of Entomology, Washington, to all the members of the Bureau calling upon them to do all in their power to further the conservation of the country's resources, and announcing the establishment of a system by which the reports of local outbreaks of insects will be received, tabulated and mapped out, and statements compiled for the use of the men in the field. Each member is asked to report promptly the first occurrence of any well-known pest or the beginning of any unusual infestation.

The Campaign for Increased Food Supplies in Alabama.—*Jl. Econ. Entom., Concord, N.H.*, x, no. 3, June 1917, p. 377.

In pursuance of the policy of economic entomologists throughout the States, Alabama workers are endeavouring to save two million dollars' worth of maize that is liable to be destroyed by insect attack during the next two or three months. Arrangements have also been made to obtain reports, at a much earlier date than would ordinarily be the case, of any threatened pest occurring within the State, when prompt measures of control will be applied.

Smyth (E. G.). **The White Grubs injuring Sugar-cane in Porto Rico. I. Life-Cycles of the May Beetles or Melolonthids.** — *Jl. Dept. Agric., Porto Rico,* i, no. 2, April 1917, pp. 47–92, 9 plates. [Received 10th June 1917.]

This paper is the first of a series on the life-cycles, enemies and methods of control of white grubs found in Porto Rico. Four species of *Lachnosterna* (*Phyllophaga*) and one of *Phytalus* have so far been found by the author; these are all new to science and are briefly diagnosed under the following names:—*Lachnosterna vandinei*, *L. portoricensis*, *L. guanicana*, *L. citri*, and *Phytalus insularis*. The only species dealt with in detail is *L. vandinei*.

Experience has shown that the problem of white grub control cannot be solved by direct methods such as poison-sprays or baits, and it is therefore necessary to rely upon natural enemies of the grubs. These include birds (of which the blackbird, *Holoquiscalus brachypterus*, is the most important and is constantly seen following the plough in search of grubs), fungous diseases, and insect parasites, both indigenous and introduced. The potential parasites of the Island include the Scoliids, *Elis sexcincta*, F., *E. xanthonotus*, Roh., *Campsomeris dorsata*, F., *C. trifasciata*, F., *C. pyrura*, Roh., and *Scolia atrata*, F.; the Tachinids, *Cryptomeigenia aurifacies*, Walt., and *Eutrixoides jonesi*, Walt.; and the Elaterid, *Pyrophorus luminosus*, Ill. In the case of the last-named only is there direct evidence of the destruction of *Lachnosterna* grubs, but present experience points to the conclusion that the two Tachinid flies are the most important and active agency in the control of white grubs in the Island. A list is given of fifteen North American insects parasitic upon *Lachnosterna*, and much is hoped from the introduction of some of these species into Porto Rico; the

results of the current experiments will be published in a later paper. Experiments in the introduction of fungous diseases of the white grub have given variable results.

The worst sugar-cane pest of the Island is *Lachnosterna vandinei*, of which the life-history and habits are described. In a small district one sugar company collected in two years 4,723,000 beetles and 4,087,000 grubs at a cost of about £1,200. The life-cycle of this species covers only one year, and the beetles may be found from February to November, the broods overlapping to such an extent as to distribute the emergence of adults over all of the summer months. Nine months are spent below ground in the larval stage, during which time the grubs are feeding upon the roots of the sugar-cane. Hand-picking is largely resorted to, hundreds of bushels of the grubs being collected in ploughed fields in the day-time and of the beetles on cane foliage at night.

L. vandinei is confined to the western third of the Island. The adult is a very general feeder, *Casuarina* and *Poinciana regia* (flamboyant) being specially subject to attack, while bananas and coconut palms often suffer severely, and sugar-cane leaves are also readily eaten.

Paddock (F. B.). **The San José Scale.**—*Texas Agric. Expt. Sta., College Station,* Circular no. 18, December 1916, 11 pp., 3 figs. [Received 11th July 1917.]

This paper gives a popular account of *Aspidiotus perniciosus*, with recommendations for spraying and formulae for lime-sulphur solutions.

Bilsing (S. W.). **The Green Bug or Spring Grain Aphis** (*Toxoptera graminum*, **Rond.**).—*Texas Agric. Expt. Sta., College Station,* Circular no. 13, March 1916, 8 pp., 2 figs. [Received 11th July 1917.]

Toxoptera graminum, Rond., is able to perpetuate itself throughout the year in Texas owing to the variety of its food-plants. It is generally supposed that dry, hot summers are unfavourable to its increase; heavy rainfall seems to be an efficient factor in control, but cold weather seems to have but little influence on its numbers. Early-sown wheat affords good protection for the Aphids and should be avoided whenever possible. All self-sown wheat and oats in the early part of the season should be destroyed. When only wingless females occur, the damage is at first confined to circular areas, which turn yellow in colour. As the insects become more numerous, they radiate out in all directions, constantly increasing the size of the damaged area. When these areas are first noticed they should be covered with straw and burned; or if this is not possible, they should be ploughed and harrowed. The wheat aphis is ordinarily kept under control by a small Braconid parasite, *Lysiphlebus testaceipes*, Cress.; this parasite is active only when the temperature is above 56° F., while the Aphid is active at 40° F., and it is when the temperature is such that the Aphid increases rapidly, while the parasite is unable to multiply, that a serious outbreak occurs.

Melander (A. L.) & Yothers (M. A.). **Twenty-Fifth and Twenty-Sixth Annual Reports for the Years ended 30th June 1915 and 30th June 1916, Division of Zoology and Entomology.**—*Washington State Coll. Agric. Expt. Sta., Pullman*, Bulls. no. 127, December 1915, pp. 30–38, and no. 136, January 1917, pp. 35–42. [Received 11th July 1917.]

Investigations for the purpose of determining the progressive immunity of insects to insecticides have shown that differences in viability are due less to the strength of the spray than to the locality where the spraying is done. Neither can the immense fluctuating differences be ascribed to climate, condition of the trees, water used in the sprays, thoroughness of application, nor apparently to any combination of extrinsic factors. Apparently there are inherent biological differences in the insects at various localities; in some districts the insects succumb readily to the spray, while in others they exhibit great powers of resistance. During the year 1915–16 scales manifested great susceptibility to lime-sulphur spray in contradiction to their behaviour of previous years in the same district; on the other hand they proved remarkably resistant to standard emulsified oils, which in the previous year had completed their extermination. It is hoped to publish the curves and tabulations of these extended investigations in a separate bulletin.

The endoparasitism of *Aphis brassicae* (cabbage aphis) and *A. pseudobrassicae* (turnip louse) has been the subject of a detailed study. The commonest parasites of these species are *Aphidius piceus* and *Xystus brassicae*, the effects of which are apparently identical. The incubation of the parasitic eggs lasts but a few hours, and the larva develops rapidly. No apparent effects are produced upon the host by the presence of the egg, nor by the larva until it is about a week old, when the host begins to exhibit signs of degeneration. It is not, however, until the parasite reaches an advanced stage and begins to move about, destroying the remainder of the degenerating tissues and the vital organs, that death takes place. Polyembryony, which is characteristic of certain species of parasites, was found not to exist in any of the species studied. Parthenogenesis was definitely ascertained to be possible under certain conditions, the resultant offspring being invariably males. One method of dissemination of the endoparasites was proved to be through the agency of the winged host-forms, which in migrating to other plants or other fields serve in the distribution of the parasites. It was definitely determined that *Pachyneuron micans* and *Asaphes rufipes* are hyper-parasites of the other parasites. Investigation into the problem of whether parasitised Aphids bear further offspring revealed the fact that reproduction does not cease immediately after the oviposition of the parasitic egg, but may continue for some days, several young being produced. The host Aphids are both attacked by a fungous parasite, which destroys many of them, particularly in the late autumn during cool, damp weather, which seems necessary for its proper development.

The root maggot [*Chortophila brassicae*] has proved to be one of the most serious pests and one of the most difficult to deal with. Experiments in control were mostly negative in result. Cabbage, kale, marrow cabbage and rape are best protected by starting them in autumn and transplanting in February or March. Tarred felt disks

should be placed about the stem close to the ground when transplanted. The most successful preventive measure proved to be the use of poison-bait spray for the adult flies.

Peranabrus scabricollis (coulee cricket), which was a serious pest of wheat in 1916, is dealt with elsewhere [see this *Review*, Ser. A, v, p. 224].

Otiorrhynchus ovatus (strawberry root weevil) threatened to become a serious pest in 1916, and various experiments in soil fumigation resulted in the adoption of carbon bisulphide as the only material of practical value, and this was effective only when applied under a cover of oilcloth or canvas. The value of the strawberry fields treated rendered this method neither prohibitive nor discouraging, and the treatment has already been carried on by several growers on considerable areas.

Bentley (G. M.). **Suggestions for the Control of Injurious Insects and Plant Diseases.**—*Univ. Tennessee Agric. Expt. Sta., Knoxville,* iv, no. 3, Bull. no. 14, September 1915, pp. 110–123, 2 figs. [Received 11th July 1917.]

This is a revised edition of a bulletin which has previously been abstracted [see this *Review*, Ser. A, iii, p. 549].

Bentley (G. M.). **Sodium Cyanide as a Fumigant.**—*Tennessee State Bd. Entom., Knoxville,* v, no. 3, Bull. no. 18, September 1916, 12 pp., 6 figs. [Received 11th July 1917.]

This paper gives detailed directions for fumigation with hydrocyanic acid gas by means of a fumigating box or house, the construction of both being described. The material chosen for the production of the gas is sodium cyanide, in place of the usual potassium cyanide, which is very little produced outside Germany and has consequently risen enormously in price since the war. Sodium cyanide is found to be in every way as successful as potassium cyanide, and as it combines more slowly with the sulphuric acid, greater safety in manipulation results for the operator. All nursery stock passing into or out of the State of Tennessee requires fumigation by law.

Paddock (F. B.). **Sprays and Spraying.**—*Texas Agric. Expt. Sta., College Station,* Bull. no. 187, March 1916, 36 pp., 8 figs. [Received 11th July 1917.]

This paper gives a useful summary of the various methods employed by growers of crops to eradicate insect pests. Insecticides are discussed under the headings of liquid and dry poisons, contact insecticides, repellents and fumigants. Spraying machinery of all kinds is described, with directions and cautions in the use of sprays. Many general preventive measures are also discussed.

Leefmans (S.). **Bijdrage tot het *Helopeltis*-vraagstuk voor de Thee.** [Contributions to the Question of *Helopeltis* and Tea.]—*Meded. v. h. Proefstation voor Thee, Buitenzorg,* no. L, 1916, 214 pp., 4 coloured plates, 6 plates, 1 map, 1 diagram.

An interim report has already been issued [see this *Review*, Ser. A, v, p. 131] of the investigations on *Helopeltis* infesting tea in Java, of which the present paper is a complete account.

The first section is systematic, the four species, *Helopeltis antonii*, Sign., *H. antonii* var. *bradyi*, Waterh., *H. theivora*, Waterh., *H. cuneatus*, Dist., and *H. cinchonae*, Mann, being described, and their distribution in Java and Sumatra recorded. A simple table is also given to enable planters to distinguish *Helopeltis* from other insects which the native collectors may bring in.

The second section deals with the biology of the different species in detail. Altitude influences the developing stadia of *H. antonii*. The egg-stage lasts 7–8 days at 800 feet, 8–11 days at 3,600 feet and up to 14 days (according to temperature) at 4,200 feet. The larval stage lasts 10–14 days at 800 feet, and 15–24 days at 3,600 feet. The females lived up to 50 days. A laboratory count showed that of 929 eggs, 610 were laid in the young green stems, 183 in the swollen base portion of the leaf-stem, 91 in the leaf-stem, and the remainder elsewhere. Neither laboratory nor field examinations have yet revealed eggs in the woody parts. In the laboratory larvae developed from 87 to 95 per cent. of the eggs from three females. The development of the larvae does not appear to be influenced by shade (= lower temperature). On most estates where catching is practised, the work is usually done between 6–8 a.m. and again between 4–6 p.m., but a considerable number of *Helopeltis* may also be taken between 8 a.m. and 4 p.m. When the heat of the sun increases the younger larvae often remain on the injured and slightly curled leaves, being sometimes found there at noon, but the older larvae seek shelter on the shaded twigs. These older larvae are very shy and quickly move downwards or let themselves fall when disturbed. The larvae of *H. antonii* do not seem to be so active as those of *H. theivora*. The planters appear to be right in thinking that larvae predominate in the morning catches and adults in the afternoon ones. The heat of the sun-warmed ground affects the larvae (this may be useful when pruning), and only when compelled do they migrate from one tea shrub to another. Once on the move their progress is rapid and neither irregular ground nor a vertical-sided trench can impede it. The probable cause of the damage to tea leaf is supposed to be a poisonous secretion in the puncture. Like the larvae, the adults prefer the under-side of the leaves and usually feed in the morning and afternoon. Unless disturbed they migrate but little. They cannot face even a moderate wind, and there is no doubt that wind-carriage is a factor in their spread. Windy situations are avoided by them. The infestation was usually more serious in valleys, on hill-sides, or at the edge of jungle or other wind barriers. Protective tree-belts are therefore useless and may even be dangerous at times, as the insects are liable to accumulate there. In one case success was obtained by cutting down such a barrier, allowing free entrance to the wind. As a result of enquiries sent to 57 estates as to the season when most damage was done, 44 replies were received indicating the west monsoon (rainy season), 5 the east monsoon (dry season), and 8, both. It is therefore important that control should be practised also in the dry season. In the author's opinion *Helopeltis* aestivates on tea. This circumstance greatly favours control. Of the plantations infested about 70 per cent. were at an altitude of 1,000–4,000 feet; 4,300 feet appears to be the extreme limit. The tea shrubs afford the insects all the shade that they require, so that the presence or absence of shade-trees is immaterial. All varieties of tea in Java were attacked,

but the so-called Java-China tea is the most liable. Some planters have thought it possible to use it to attract *Helopeltis,* but it is dangerous to grow it near Assam tea.

Helopeltis cannot be combated on cinchona unless the plantations are very young, and it can multiply on this plant to an unlimited extent. It is therefore advisable to decrease the danger as much as possible by doing cultural work (cutting and hoeing) in cinchona plantations before adjacent tea-gardens are in the condition most susceptible to *Helopeltis* attack.

An elaborate investigation was made on the food-plants of *H. antonii,* on the weeds occurring in tea-gardens and on the leguminous plants used for green manuring. It was found that *H. antonii* could not live on *Leucaena glauca* and *Clitoria cajanifolia. Tephrosia vogelii* is definitely dangerous, and caution is advised in respect of *T. candida, T. hookeriana* var. *amoena, Albizzia moluccana* and *Erythrina indica* (dadap). When infestation is severe not only the tea, but also the green manure plants should be pruned. Dangerous food-plants are *Bixa orellana* and *Gardenia florida,* often used for hedges. Weeds which were attacked under laboratory conditions, and on which *Helopeltis* lived for a considerable time, included *Richardsonia brasiliensis, Melastoma malabarthricum, Erigeron linifolium, Bidens pilosa, Dichrocephala latifolia,* and *Erechtitis valerianaefolia.* These weeds were also attacked in the tea gardens, chiefly when the tea was pruned low. Clean weeding therefore seems advisable very soon after (sometimes before) pruning, in order to prevent the insects from remaining on the weeds until the tea shrubs bud again. The awi tali bamboo (*Gigantochloa apus*) is suspect, for the insects remained alive on it for 10 days, while casso (*Saccharum spontaneum*), alang alang (*Imperata arundinacea*) and *Lantana camara* seem harmless. It was not possible to find a bait-plant more attractive than tea. On one plantation *Villebrunnea rubescens* had been planted in places as an attraction for *Helopeltis,* on account of spots being noticed on its leaves. These turned out, however, to be due to *Pachypeltis vittiscutus,* Bergr., a fact which points to caution in assuming that injury similar to that done by *Helopeltis* is necessarily due to *Helopeltis.* A list is given of 44 food-plants of *Helopeltis* mentioned in literature. The author states that *H. antonii* from tea lived up to 21 days on cacao, so that cacao growing near to tea may be endangered.

H. theivora, Waterh., also oviposits in the young stems chiefly, but it has a greater liking for the leaf-nerve than *H. antonii.* Its eggs develop in 7–8 days on an average. Its newly-hatched larva has the same appearance as that of *H. antonii,* but after the first moult differences become distinctly visible. The longest time a female was observed to live was 42 days ; the longest oviposition period was 32 days ; the maximum number of eggs was 172. The injury done by *H. theivora* cannot be distinguished from that by *H. antonii.* The green manure plants on which *H. theivora* can live while tea is being pruned are *Albizzia moluccana, Erythrina indica, Tephrosia candida, T. vogelii,* and *T. hookeriana.* On *Leucaena glauca* and *Clitoria* it only survives for a short time. In west Java it lives and breeds on cacao. Experiments with weeds gave practically the same results as in the case of *H. antonii.*

H. cinchonae, Mann, was found on tea at a height of 5,000 feet, that is, above the limit for *H. antonii*. It causes injury similar to that of *H. antonii* and *H. theivora* and can breed on tea. It greatly prefers tea to cinchona. The egg-stage lasts 18–19 days; the larval stage, probably 24–30 days. *H. cuneatus*, Dist., has not been observed to attack tea.

An insect which may be mistaken for *Helopeltis* is the Capsid bug, *Pachypeltis vittiscutus*, Bergr., the injury of which, as stated above, might be thought to be due to *Helopeltis*. It apparently occurs throughout Java and has a considerable vertical range—on cinchona up to 5,000 feet and on other food-plants up to 1,000 feet.

After discussing the natural enemies of *Helopeltis* [see this *Review*, Ser. A, v, p. 132] a full description of control measures is given. Immediately after pruning, the shrubs must be sprayed with a 2 per cent. soap solution; collection may also be carried out. Spraying may be continued for seven months; after that collection must be resorted to. Weeding must be simultaneous with, or immediately subsequent to pruning. If they have been planted, dangerous plants must be pruned when tea is pruned. Such hedge-plants as *Bixa orellana* and *Gardenia grandifolia* should not be tolerated. Pruning must never be done against the wind. During the rainy seasons prunings must be destroyed on the same day; this is not necessary in the normal dry season if they are spread out in thin layers. At an altitude under 4,300 feet all cultural methods causing the pest to migrate from cinchona must be finished before adjacent tea gardens are pruned. The larger the area pruned in the shortest possible time, the longer will the gardens remain uninfested. As a general rule it is well to prune at least 70 acres a month. Adjacent estates should prune at the same time. The collection of egg-bearing twigs is useful if due regard is paid to the developing period of the eggs. Control must not be stopped if only a few *Helopeltis* are present, and it must be begun as soon as the first *Helopeltis* are reported. A premium for keeping the gardens free is advisable. Severely attacked gardens should not be pruned if newly-pruned gardens are adjacent. It is better to wait until the number of insects has decreased or the pruned gardens have recovered. In no other case must the pest be left unchecked. Remedial measures must be applied immediately injury is detected, for later on they are of little avail.

Further work is being done in regard to variations in pruning, the resistance of tea, the influence of fertilisers, etc.

BERNARD (C.). **Verslag van het Proefstation voor Thee over het Jaar 1916.** [Report of the Tea Experiment Station for the Year 1916.] —*Meded. v. h. Proefstation voor Thee, Buitenzorg*, liii, 1917, pp. 1–12, 1 plate.

While tea was generally free from disease and insect infestation during the year, *Helopeltis* occurred on some estates, its injury being usually followed and increased by red rust. Heer Leefmans' work on *Helopeltis* has already been dealt with [see this *Review*, Ser. A, v, pp. 131, and above], while in regard to the Trypetid, *Adrama determinata* (tea-seed fly), his experiments confirm the inability of the fly to bore into the husk of healthy ungerminated seed [see this *Review*, Ser. A, iii, p. 434]. A serious attack by *Tarsonemus translucens*

(yellow tea mite) was reported near Buitenzorg. Owing to the wet east monsoon, *Brevipalpus obovatus* (orange tea mite), *Eriophyes* (*Phytoptus*) *carinatus* (purple tea mite) and other mites did but little damage.

de Bussy (L. P.). **Seeds attacked by** *Lasioderma* **in Sumatra.**—*Meded. v. h. Deli Proefstation, Medan*, x, no, 5, April 1917, p. 124.

Circular no. 28 of 4th December 1916, issued by the Deli Experiment Station, draws attention to the fact that coriander (*Coriandrum sativum*) and caraway (*Carum carui*) are very attractive to *Lasioderma serricorne* and should be inspected as well as tobacco.

de Bussy (L. P.). **The Toa-toh Moth,** *Phthorimaea operculella*, **on Wild Tobacco.**—*Meded. v. h. Deli Proefstation, Medan*, x, no. 5, April 1917, p. 126.

Circular no. 30 of 18th February 1917, issued by the Deli Experiment Station, emphasises the necessity of removing and burning wild tobacco, as *Phthorimaea operculella* (*Lita solanella*) has never been found in Deli except on tobacco and therefore evidently lives on wild tobacco when the cultivated plants are not available.

[Keuchenius has suggested that this insect is really *P. heliopa*, Low. (see this *Review*, Ser. A, iv, p. 80).—Ed.]

de Bussy (L. P.). **Voorschrift voor het bewaren van afgepakte tabak met het oog op** *Lasioderma* **en tabaksmot.** [Instructions for storing baled Tobacco with Reference to *Lasioderma* and the Tobacco Moth.]—*Meded. v. h. Deli Proefstation, Medan*, x, no. 5, April 1917, p. 127.

As a large portion of the 1916 Sumatran tobacco crop will have to be stored some months before shipment, precautions must be taken against *Lasioderma serricorne* and the tobacco moth [?]. Great vigilance is needed in watching that these pests are absent from the fermenting sheds or other parts of the factory. The bales must be well covered up and turned once a month, when a couple out of every hundred must be most carefully examined, special attention being paid to the tobacco at places which have been in contact with seams in the covering. Wide-mouthed bottles containing tobacco leaves or cigars should be placed in various parts of the sheds as traps and must be inspected once monthly. A couple of drums of carbon bisulphide should always be kept in stock for immediate use if necessary.

Keuchenius (P. E.). **Ziekten en plagen van de klapperkultuur in Ned.-Indië en hun bestrijding.** [Diseases and Pests of Coconuts in the Dutch East Indies and their Control.]—*Teysmannia, Batavia*, nos. 11–12, 1916, pp. 579–642, 8 plates. [Received 30th June 1917.]

This paper is an amplification of a previous review of coconut pests, giving brief notes on the injury and methods of control and mentioning both useful and noxious insects [see this *Review*, Ser. A, iv, p. 236].

Hymenopterous pests include :—*Oecophylla smaragdina*, F., which would be useful owing to its predatory habits if it did not tend the coconut scales, *Lepidosaphes pinnaeformis* and *Aspidiotus destructor*. Its nests should be burnt, or cut off and submerged in water.

Coleoptera. The Curculionid, *Rhynchophorus ferrugineus*, Oliv., is one of the two chief pests of the coconut, the other being the Dynastid, *Oryctes rhinoceros*, L. *R. ferrugineus* also attacks the palm, *Arenga saccharifera*. Collection is the control advised. *Rhabdocnemis interruptocostata*, Schauf., can be very dangerous and, like *Rhyncophorus ferrugineus*, infests cuts made by the natives in order to facilitate climbing. It is also found in the newly-formed fruit when these are attacked by *Melissoblaptes rufovenalis*. It is probably identical with *R. obscurus*, Boisd., described by Zacher as a coconut pest in Samoa and known from Hawaii and Fiji as infesting coconut, banana and sugar-cane. *Diocalandra frumenti*, F. (*stigmaticollis*, Gyl.), has habits similar to those of *R. interruptocostata*. Koningsberger states that the larvae of *Protocerius colossus*, Oliv., *Omotemmus miniatocrinitus*, Chev., and *Cyrtotrachelus* sp. are found within the stem. They are not dangerous, as they occur in limited numbers. The Hispid, *Botryonopa sanguinea*, Guér., which feeds on the leaves, cannot be considered a dangerous pest as yet, but *Brontispa longissima*, Gestro, which attacks young palms under five years of age only, does such injury as to warrant control by removing and destroying the infested leaves. The Dynastid, *Oryctes rhinoceros*, L., is well known as the chief enemy of the coconut palm ; measures for its control are fully described. Another Dynastid, *Xylotrupes gideon*, injures the young leaves in the crown. This beetle is abundant on *Murraya exotica* and *Poinciana regia*. According to Froggatt, *X. nimrod* (a synonym of *X. gideon*) causes the same injury as *O. rhinoceros*. The Lucanid, *Eurytrachelus pilosipes*, Waterh., was reported by Zacher as a serious pest of young palms in the Solomon Islands, boring into the trunk and leaf-bases. In Samoa *Alcimus dilatatus*, Fairm., was found by Gehrmann in decayed trunks and leaf-stems, and it also appeared to be a pest of sugar-cane. Preuss reported *Eurytrachelus intermedius*, Gestro, and *Metopodontus cinctus*, Gestro, as injuring the flower-buds. The author lists the following Lucanids as injuring flower-buds in the Malay Archipelago, while it is not improbable that they injure the trunk and the leaf-stems in the crown also :—*Eurytrachelus bucephalus*, Perty, *E. gypaëtus*, Cast., *Odontolabis bellicosus*, Cast., *Metopodontus occipitalis*, Hope, and *Prosopocoelus zebra*, Oliv. The first three are the more abundant.

Lepidoptera. *Melissoblaptes rufovenalis*, Snell., was first noticed in 1914 in Java and has since spread over the whole island. The author holds this borer to be quite as dangerous in Java as *Oryctes rhinoceros*. The young caterpillars occur in the newly-opened flower-sheath where they feed on the male and female flowers. The failure of entire crops may be traced to this insect, which is not checked by the two natural enemies observed, an Ichneumonid and an earwig (*Exypnus pulchripennis*), which latter is of great importance. The caterpillars of the Noctuid, *Simplicia marginata*, Moore, are a leaf-eating pest of the coconut. An unidentified Limacodid caterpillar found around and on the trunks of the palms is feared by the coolies on account of its stinging spines. Outbreaks of the Zygaenid, *Brachartona catoxantha*,

Hamps., occurred in Central Java in 1914 and 1915. A Tachinid parasite is abundant during such infestations, but not sufficiently so as to prevent injury to the coconut leaves, and other enemies are an Ichneumonid and a fungus, *Botrytis necans.* Koningsberger reported that the caterpillars of the Nymphalid, *Amathusia phidippus*, L., are somewhat abundant on the leaves. The Hesperids, *Hidari irava*, Moore, and *Erionota thrax*, L., are two other leaf-eating pests. In the case of tall palms it is difficult to control the above four pests by spraying, but the caterpillars may be shaken down and collected; while if they have already pupated, the only remedy consists in cutting off and burning the leaves. In the case of young palms collection or spraying with 3% lead arsenate are the measures advised.

The scale-insects attacking the coconut are *Lepidosaphes pinnaeformis*, Bch., *Aspidiotus destructor*, Sign., and an undetermined black scale (? *Ceroplastes actiniformis*, Green), and a whitefly, *Aleurodicus destructor.*

A termite enemy, *Coptotermes gestroi*, Wasm., and the Acridiid, *Cyrthacanthacris nigricornis*, Burm. (*Acridium melanocorne*, Serv.), injure the coconut in Java. An outbreak of the latter pest is sometimes accompanied by the appearance of its fungus parasite, *Metarrhizium anisopliae.*

OSTERWALDER (A.) **Der Obstbaumkrebs.** [Fruit Tree Canker.]—*Schweiz. Zeitschr. f. Obst.- u. Weinbau, Frauenfeld*, xxvi, nos. 15–16, 7th–21st July 1917, pp. 228–233, 241–247, 7 figs.

In order to avoid confusion it will be necessary in future to state whether fruit-tree canker is due to frost, to fungi, or to attack by insects, such as *Enarmonia* (*Grapholitha*) *woeberiana*, Schf., and *Aegeria* (*Sesia*) *myopaeformis*, Bkh. In the last-named case it may perhaps be found necessary to state whether the canker is solely due to the insects, as there is a possibility of the injury being originally due to the infection by *Nectria galligena.*

OSBORN (H.) & DRAKE (C. J.). **Notes on American Tingidae with Descriptions of New Species.**—*Ohio Jl. Sci., Columbus*, xvii, no. 8, June 1917, pp. 295–307, 2 figs.

The following are some of the Tingids dealt with in this paper, with their host-plants:—*Corythuca ciliata*, Say (sycamore or button-wood Tingid), the adults of which are parasitised by a red mite and may be collected in winter beneath the loose bark of trees; *C. arcuata*, Say (oak lace-bug), of considerable economic importance in Wisconsin; *C. juglandis*, Fitch, on walnut, butter-nut and linden; *C. salicis*, sp. n., infesting willow and currant; *C. marmorata*, Uhler, causing damage in greenhouses; *C. gossypii*, F., taken on *Ichthyonethia piscipula* in Florida; *C. coryli*, sp. n., a common species that infests hazel-nuts; *C. floridana*, Heid., very destructive to oak-trees; *C. pergandei*, Heid., infesting alder; *C. crataegi*, Morrill, the hawthorn Tingid; *C. pallida*, Osborn & Drake, on linden and mulberry; and *C. pruni*, Osb. & Dr., *C. padi*, Drake, and *C. associata*, Osb. & Dr., three wild cherry Tingids.

J. C. Hutson. **Some Weevils of the genus *Diaprepes* in the West Indies.**—*Agric. News, Barbados,* xvi, no. 395, 16th June 1917, p. 186.

The weevils of the genus *Diaprepes* (which are adults of the root borer grubs) occurring in the West Indies form two distinct groups, some being varieties of *Diaprepes abbreviatus* and some of *D. famelicus.* A table is given showing the different varieties in each group and their distribution in the Islands.

Feytaud (J.). **La Courtilière** (*Gryllotalpa vulgaris,* **Latr.**). [The Mole-cricket.]—*Bull. Soc. d'Etude Vulg. Zool. Agric., Bordeaux,* xvi, no. 6, June 1917, pp. 49–56, 1 fig.

Notes on the life-history and habits of the mole-cricket [*Gryllotalpa gryllotalpa,* L.], which is a pest of garden plants and young crops in France, are given in this paper. Methods of control include the following:—Young and delicate plants should be screened in as a protection from the insect. Naphthaline spread about the ground in the proportion of $4\frac{1}{4}$ oz. to the square yard is said to repel the crickets; rags soaked in paraffin would serve the same purpose. Phosphorus and arsenical pastes for poisoning the insects, and the use of calcium carbide for asphyxiating them by freeing the acetylene in the soil are also suggested, but these methods are as yet in the experimental stage. Carbon bisulphide injections may be employed towards the end of September or in mid-winter. The injections should be made early in the morning, in dry soil, using $\frac{5}{7}$ oz. to $\frac{6}{7}$ oz. per square yard in four injections about 6 to 8 in. deep in September or 1 ft. deep in February. The holes should at once be closed up. In June and July the position of nests is easily located, and when dug up intact, the eggs can all be crushed or burned; if the nest is broken by the pick the young will die in great numbers. The galleries can be located by levelling the soil, raking and watering. The following night the crickets form new galleries and openings, and on turning up the soil the shelters are laid bare and can be treated with water, paraffin emulsion or any other insecticide. Various traps resembling miniature rat-traps have been devised without great success in proportion to their cost. Bait-traps are better; these are earthenware or metal pots sunk into the ground into which the crickets fall and cannot escape. A little water should be put in them. Shelter-traps are more effective. Damp matting or wicker baskets, or slices of pumpkin all attract and shelter some individuals, but the best shelter-trap is made by spreading farm manure in shallow trenches some 10 or 12 inches deep every 4 or 5 yards. This should be laid in September, and in mid-winter the manure is turned up, exposing the crickets, which can be destroyed *en masse.* This is probably the most effective, the least expensive, and least troublesome method of control.

Roullard (F. P.). **The Mediterranean Fig Scale** (*Lepidosaphes ficus*). —*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vi, no. 6, June 1917, pp. 246–248, 4 figs.

Lepidosaphes ficus was introduced into California on fig cuttings from Algeria in 1904–1906, and the pest has now spread over an area

with a radius of about $\frac{3}{4}$ mile; so that it is not easily established and is spreading slowly. The female winters beneath the scale, and oviposition begins about mid-March, the young emerging during April, and infesting the whole tree by the beginning of June.

Methods of control are being tried, a dormant spray used not later than the first week in March being apparently the most promising measure. Two ladybird parasites have been found feeding on the scale, these are *Chilocorus bivulnerus* (twice-stabbed ladybird) and *Lindorus lophantae* (Koebele's ladybird).

Van Dyke (E. C.). **A newly introduced Clover Beetle,** *Sitones hispidulus*, **Germ.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vi, no. 6, June 1917, pp. 248–249.

The author records having observed some thirty specimens of this weevil crawling up the side of a house, evidently migrating from the white clover in the adjacent lawn. This is the first time it has been noted in California. The species was first recorded from Long Island in 1876 and has now spread throughout the north-eastern States and Canada, and also to parts of Oregon and Washington.

Smith (H. S.). **A Scale Insect new to California.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vi, no. 6, June 1917, p. 249.

A palmetto has been found to be infested with the palmetto scale, *Comstockiella sabilis*, Comst., which has not been observed elsewhere in California. The owner states that it has been present on the tree for some fifteen years, and has never attacked any of the other forty odd varieties of palms growing beside it. Attempts will be made to eradicate it.

Urbahns (T. D.). **Destroy the Grasshoppers.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vi, no. 6, June 1917, pp. 249–253, 4 figs.

The most destructive species of grasshoppers in California are *Melanoplus devastator*, *M. differentialis*, *M. atlantis*, *M. bilituratus*, *Camnula pellucida* and *Schistocerca venusta*. It is of the greatest importance in controlling these pests that the breeding grounds of the various species should be located. These may be discovered by watching where the adults collect in late summer and by the appearance in great numbers of small hoppers in early spring. Those species which breed in the grass-covered slopes of the foot-hills hatch in early spring, feed upon the green, tender grasses for a time and then work their way down the hill-sides into cultivated fields. They should be poisoned while young and before they leave the breeding ground. Grasshoppers breeding in cultivated farming areas first appear in numbers along uncultivated ditch banks, roadsides, fence lines, etc. It is here that poison should at once be distributed. Formulae for poisons are given and the method of distribution described; this is best done by hand over small areas and in large areas by means of a grain-seeder attached to the rear of a farm wagon and geared from one of the rear wheels. The poison should be spread in the early afternoon and before irrigation, rather than after.

SMITH (H. S.). **The Argentine Ant as an Orchard Pest.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vi, no. 6, June 1917, pp. 254–258, 3 figs.

While the Argentine ant, *Iridomyrmex humilis,* has long been recognised as an unrivalled household pest, it is only recently that fruit-growers have realised the damage this insect indirectly causes to the fruit industry owing to its influence on infestations of mealy-bugs, black and soft brown scales. By protecting the mealy-bugs from their natural enemies, such injurious pests as *Pseudococcus citri,* which infests citrus and fig trees, and *P. calceolariae,* a pest of the sugar-cane, are allowed to increase unchecked. Experiments carried on for two years have demonstrated that if ants can be kept from citrus trees the citrus mealy-bug is kept in complete subjection by its natural enemies. The most successful methods of control as yet devised against *I. humilis* consist of barriers which the ants cannot cross, and poisoning. Tanglefoot, to which finely powdered sulphur has been added in the proportion of one part sulphur to six parts tanglefoot, is placed in a band about 5 inches wide around the trunk of the tree and is effective if properly mixed and kept in good condition. The preparation of this barrier, and also of a corrosive sublimate band, has already been described [see this *Review,* Ser. A, v, p. 105]. A more promising method, although it is at present rather in the experimental stage, is that of poisoning, using a poison which is so dilute that the ants will carry it to their nests in large quantities as food for the queens and larvae, which succumb to its effects in two or three weeks. A strong poison is far less effective, as it would kill the workers before they are able to reach the nest. The formula given for this poison is: granulated sugar, 15 lb.; water, 7 U.S. pints; crystallised tartaric acid, $\frac{1}{4}$ oz. This, when boiled for 30 mins. and allowed to cool, forms a syrup. A poison solution of sodium arsenite (C.P.) $\frac{3}{4}$ oz., in 1 U.S. pint hot water, is allowed to cool and then added to the syrup and well stirred; $1\frac{1}{2}$ lb. of honey is then stirred in. A good container for the poison consists of pound or half-pound paper bags with flat bottoms into the sides of which a few holes are punched. They are then dipped, closed, in hot paraffin and opened before cooling. About 2 oz. of syrup are placed in each bag, the top being then folded over and the bag tacked to the trunk of the tree. In experimental plots where the poison has been out for a month the ants are difficult to find on the trees, while in untreated plots in the same orchards they occur in enormous numbers. If at the end of the season the poisoning method has proved an effective control of the ant, a general campaign should be organised on these lines.

SEVERIN (H. H. P.). **Dark Currant Fruit Fly in California** (*Rhagoletis ribicola,* **Doane**).—*Mthly. Bull. Cal. State Conmiss. Hortic., Sacramento,* vi, no. 6, June 1917, pp. 258–260, 1 fig.

A single specimen of this fly was captured in California in 1915 at an altitude of 7,500 feet. It is of considerable economic importance in Washington, where it is found about currant and gooseberry bushes in June and July. Eggs are deposited beneath the peel of the berry and the larvae upon hatching eat to the centre of the berry. When mature, after three or four weeks, they bore their way out of the fruit

and enter the soil a short distance or shelter beneath leaves or rubbish and pupate, the adults emerging in the following spring. Controls suggested are to remove the soil to the depth of about 1 inch below the bushes and bury it deep or expose it so that the pupae will be killed. Chickens will devour the larvae and pupae under the bushes. In bad infestations, to pick and destroy the whole crop before it begins to ripen and before any berries drop will ensure a clean crop until the pest is again introduced from outside.

Maskew (F.). **Quarantine Division. Report for the Month of March 1917.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vi, no. 6, June 1917, pp. 261–262.

The following pests were intercepted:—From British Columbia: *Rhizoctonia* and *Fusarium* sp., on potatoes; *Aleurodes* sp., on holly. From China: *Cylas formicarius*, in sweet potatoes; *Cladosporium citri*, on oranges; *Aphis* sp., on green vegetables; and Lepidopterous larvae in dry roots. From Florida: *Phomopsis citri* and *Lepidosaphes beckii*, on grapefruit. From Hawaii: *Diaspis bromeliae* and *Pseudococcus bromeliae* on pineapple; *Coccus longulus* on betel leaves; *Chrysomphalus aonidum* on green coconuts; Trypetid larvae in mangoes and cucumbers. From Japan: a Coccid on persimmon trees; *Pseudaonidia duplex* and *Parlatoria* sp., on camellias; Lepidopterous larvae and *Fiorinia* sp., on *Cephalotaxus*; *Poliaspis pini*, on pines; Cicada eggs and *Thyridopteryx ephemeraeformis*, on persimmon; *Pseudococcus* sp. and Cicada eggs, on azaleas. From Mexico: *Heliothis obsoleta*, on tomatoes; *Anthonomus grandis* var. *thurberiae*, in cotton bolls; *Chrysomphalus aurantii*, *C. dictyospermi*, *Lepidosaphes gloveri* and *Parlatoria pergandei*, on limes; *Lepidosaphes beckii*, on lemon. From New South Wales: *Fiorinia fioriniae* on kentia palms. From Louisiana: *Chrysomphalus aonidum*, *Ceroplastes* sp. and *Coccus hesperidum*, on unidentified shrubs. From Ohio: *Coccus hesperidum*, on crotons.

Popenoe (C. H.). **Mushroom Pests and How to Control Them.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bulletin no. 789, February 1917, 15 pp., 7 figs.

Pests of cultivated mushrooms include the larvae, commonly known as "mushroom maggots," of *Sciara multiseta*, Felt, *S. agraria*, Felt, and *Aphiochaeta albidihalteris*, Felt. The eggs, which are usually placed at the juncture of the stem and cap of the mushroom, or in the soil at its base, hatch in warm weather in about three days. The larvae at once bore into the stem or cap of the plant, riddling it for 7 to 10 days, when it is entirely destroyed. They then enter the ground, spin a cocoon just beneath the surface, and pupate, the adults emerging in 4 to 7 days. A second generation very soon appears, and the increase is remarkably rapid, each female being capable of laying nearly 1,000 eggs. Where it is possible to keep the temperature of the mushroom house at 55° F., or reduce it to that temperature when infestation occurs, the pests are easily controlled. The compost should be thoroughly disinfected before the mushrooms are planted

by heating to 150° F. or by fumigation with carbon bisulphide, used in the strength of 2 to 4 lb. per 1,000 c.ft. of space. For destroying the adults, the houses can be fumigated with tobacco or nicotine preparations such as are used in greenhouses, the treatment being made once a week during the bearing season. Dusting fresh pyrethrum insect powder over the beds is also effective against the larvae, if applied in time.

Tyroglyphus lintneri, Osb. (mushroom mite) is very prolific in mushroom beds, feeding upon the plants in all stages and destroying the mycelium. The life-cycle of the mite occupies only a few days, so that its increase is extremely rapid. Under certain conditions the hypopus or migratory stage is reached, the mite developing a hard, chitinous covering, with short legs for walking, but lacking mouth-parts. Sucking disks are provided on the ventral surface of the body by means of which the hypopus attaches itself to some insect and is transported to other breeding grounds. On arrival at a suitable spot, the mite detaches itself from the insect, to which it has caused no injury. In the hypopus stage the mite is capable of suspension of vitality for an almost unlimited time, and in all stages is very difficult to control, being unaffected by fumigants or dust sprays. Prevention is therefore the best means of control, and a compost thoroughly infested should be destroyed and the woodwork of the house washed with creosote or crude carbolic. The house should then be screened against re-infestation by the mites. A predaceous Gamasid mite is sometimes so numerous as to exterminate the pest, and does not injure the mushrooms.

Achoreutes armatum (springtail) is attracted to the manure used in the compost and in cases of heavy infestation may entirely destroy whole beds. Pyrethrum powder has been found fairly effective in control, or fumigation by hydrocyanic acid gas at a strength of 3 to 6 oz. per 1,000 c.ft. This treatment should be given after picking, as the gas injures the caps.

Other mushroom pests dealt with are sowbugs, slugs and crickets. As a general method of prevention against pests in the compost, the author recommends sterilising the manure before planting in vats or boxes through which steam pipes are conducted. The compost should be heated to 150° F., which will destroy all animal life.

GILLETTE (C. P.). **Some Colorado Species of the Genus** *Lachnus*.—*Ann. Entom. Soc. America, Columbus, Ohio*, x, no. 2, June 1917, pp. 133–146, 2 plates.

The species described include *Lachnus coloradensis*, sp. n., which is commonly found on Engelmann and blue spruces in Northern Colorado; it is a bark-feeder and is always found attacking the small limbs. *L. palmerae*, sp. n., was taken on blue spruce and *Picea engelmanni*; the injury is similar to that done by the previous species. *L. braggi*, sp. n., taken feeding on the bark of twigs of blue spruce, *Picea parryana* being apparently the only species attacked. *L. tomentosus*, De Geer, taken from needles of *Pinus radiata* and from *P. scopulorum*; *L. ponderosae*, Williams, taken on the bark of twigs of *Pinus ponderosa* and from *P. scopulorum*.

Florence (L.). **The Pacific Coast Species of *Xylococcus* (Scale-Insects).** —*Ann. Entom. Soc. America, Columbus, Ohio,* x, no. 2, June 1917, pp. 147–166, 4 plates.

The following species are described, with notes on their life-histories: *Xylococcus macrocarpae*, Cole, found on Monterey cypress (*Cupressus macrocarpa*); *X. quercus*, Ehrh., on *Quercus chrysolepis*; *X. alni*, sp. n., on alder. A table is given of the North American species of *Xylococcus*.

Baumberger (J. P.). **Hibernation: A Periodical Phenomenon.**—*Ann. Entom. Soc. America, Columbus, Ohio,* x, no. 2, June 1917, pp. 179–186.

Various hypotheses have been proposed regarding the causes of the quiescent condition of many insects during winter which is known as hibernation. The most common explanation offered is that low temperature or low mean temperature is conducive to hibernation. Experiments carried on during the past two years with the banana fly, *Drosophila melanogaster*, Mg., have shown, however, that a persistent quiescent condition was in no case brought about by the stimulus of low temperatures, larvae and adults after 20 days in an ice box being immediately activated by restoration to high temperature. The stimulus of relative humidity was determined by experiments on the caterpillars of *Isia isabella* and *Apantesis nais*, which hibernate as larvae at a definite date, irrespective of low temperatures. In these cases, high temperature, abundant fresh food and any relative humidity was found an insufficient stimulus to overcome the tendency of the insects to hibernate. Consequently, it is evident that the state of quiescence is predetermined.

In previous experiments with *Lasiocampa quercus*, which hibernates before the temperature has lowered, by keeping larvae on ice it was possible to cause them to pupate in May, and continued selection of precocious larvae for six generations decreased the length of the larval stage from 245 to 112 days. The pupal period was lengthened sufficiently to make up the difference. Similar experiments with *Dendrolimus pini* gave a second generation and no persistence of the normal cycle. This may be due to the fact that *L. quercus* feeds on the leaves of deciduous trees, while the food of *D. pini* is evergreen. There is thus a variability in the characteristic feature of hibernation; certain insects have a definite periodical hibernation which is hereditary, and if this quiescence be overcome by artificial means, the insects, by a compensatory lengthening of the next stage, regain the normal rhythm of existence. Other insects are more plastic, merely remaining quiescent during periods of low temperature and regaining activity immediately after the temperature is raised; such are *Drosophila*, *Cirphis* (*Noctua*) *unipuncta*, cockroaches, *Musca domestica* and others. The factors determining this variability are: (1) Climate. Insects do not hibernate in the tropics, where there is no cold period, and if introduced into temperate regions cannot be induced to hibernate. (2) Food. Insects which feed on materials constantly available do not show a definite periodicity. Thus the house-fly will oviposit at any time of year in appropriate temperature, and insects which feed

on evergreen trees are less rhythmical in their hibernation than those which feed on deciduous trees. (3) Exposure may determine the elasticity of the periodicity. Thus *Isia isabella*, which hibernates under stones in a rather exposed condition, has a definite period of hibernation, while the army worm [*Cirphis unipuncta*], which hibernates deep in the ground, does so only upon direct stimulus. These three factors may also determine the stage or stages in which different species of insects hibernate. Tables are given bearing out this hypothesis. Investigations into the life-histories of the Tortricids of European forests show that those species which feed on the outside of the tree hibernate in a resistant stage, that is, as eggs or pupae, whereas those which feed on the inside of the tree, and are thus protected, hibernate as larvae.

General conclusions reached by these investigations are that insects hibernate as adults when their food habits are such that oviposition can take place on suitable material at the first warm weather; as larvae, when protected from the cold and thus able to continue feeding to the latest date possible; and as pupae or eggs, because they are the non-feeding, resistant stages. There is no evidence to determine whether these adaptations were established by selection, mutation or inherited tendency. Hibernation has, however, obviously resulted from the repeated effect of winter upon the species, and the degree to which this phenomenon has become rhythmical has been determined by the habits of the insect.

Muir (F.). **The Introduction of** *Scolia manilae*, **Ashm., into the Hawaiian Islands.**—*Ann. Entom. Soc. America, Columbus, Ohio*, x, no. 2, June 1917, pp. 202–210.

Scolia manilae, Ashm., is being successfully established in Hawaii as a control for *Anomala orientalis*, Waterh., and *Adoretus tenuimaculatus*, Waterh., the former beetle is a pest that injures the roots of sugar-cane and has been found very difficult of extermination owing to the total absence of any of its natural enemies in Hawaii; the latter constitutes one of the worst garden pests of the Islands, doing much injury to roses and ornamental shrubs. As these pests were both introduced from Japan, where *Scolia* is an important factor in control, it was decided to attempt the introduction of *S. manilae* into Hawaii. Grubs of *Anomala* or *Adoretus*, which bore an egg of *S. manilae*, were placed each one in an artificial mud cell and the entrance closed with mud. The cells were packed in moist soil in tins with close-fitting lids and the tins in wicker baskets or boxes were shipped from Manila to Honolulu. By the time their destination was reached, the Scolias had pupated and the cocoons were then placed in damp moss and the adults, when hatched, mated in captivity. In all, many thousands of *Scolia* have been shipped to Honolulu, and although it will not be possible to estimate their effect on *Anomala* and *Adoretus* before the end of the present year, it is evident that the parasite is well established and prospects of control are good. Experiments with *Tiphia*, two species of *Prosena*, a *Dexia* and a *Campylotheca*, and also with several predators, have given less satisfactory results.

Keilin (D.). **Recherches sur les Anthomyides à larves carnivores.** [Research on Anthomyids with Carnivorous Larvae.]—*Parasitology, London*, ix, no. 3, May 1917, 125 pp., 11 plates, 41 figs.

The author begins by briefly reviewing our knowledge of carnivorous habits among Diptera in general, with special reference to the work of Portchinsky [see this *Review*, Ser. B, i, p. 108 and p. 149]. As a result of studying the structure of the pharynx of cyclorhaphic Diptera with regard to their mode of life, he discovered in 1911 a certain number of other carnivorous larvae, and in 1914, while studying Anthomyiid larvae, was able to add two more carnivorous species to the list. Others have been noted still more recently. All these investigations lead to the conclusion that carnivorous habits among cyclorhaphic Diptera are by no means exceptional, and further research will probably lead to the discovery of many more species or genera with carnivorous larvae. All the species noted as carnivorous by both Portchinsky and the author belong to the group Anthomyiidae. The morphology of the species studied in the present paper is very fully dealt with and illustrated with a fine series of plates. The species include: *Melanochelia riparia*, Fall., which is found abundantly about the dams of mill-streams and under the moss growing beside little cascades. These larvae remain attached by small hooks growing from the posterior extremity to the tufts of moss, and there prey upon small Oligochaetes, larvae of other Diptera, etc. The author has even observed a large *Gammarus* being devoured by one of the larvae. Parasites of this species are the Ichneumonids, *Atractodes riparius*, Ruschka, and *Hemiteles bicolorinus*, Grav.

Graphomyia maculata, Scop., was found in small marshy pools filled with vegetable débris, where larvae of *Eristalis* sp., *Ptychoptera contaminata*, L., and various Tipulids, Tabanids and Scatophagids were to be found; these are attacked vigorously by the *Graphomyia* larvae. If deprived of animal food, the larvae can remain a long time without nourishment, often immersing themselves entirely in the water, except for the posterior extremity which remains above the surface.

Allognota agromyzina, Fall., in the larval stage has been found in March between damp and decaying leaves beside a pond, where it is carnivorous, chiefly feeding upon small Oligochaetes.

Phaonia cincta, Zett., occurs in wounds in the trunks of elm trees, among the soft earthy débris found in shallow cavities in the branches. Various other species are found in the same habitat, the larvae of *P. cincta* being always carnivorous, and feeding chiefly on the larvae and nymphs of *Mycetobia* or of Ceratopogonids, and sometimes on the soft larvae of *Aulacigaster* or *Eristalis*.

Observations on other species of *Phaonia* indicate that the larvae of many species are carnivorous. *Phaonia trimaculata*, Bch., has been the subject of special investigation, being of considerable economic importance. These larvae were found in the roots of cabbage plants, accompanied by *Chortophila brassicae*, which was destroying the roots, and have also been observed in beetroots and in turnips. One turnip contained two distinct groups of Anthomyiid larvae; one group, the more numerous, consisted of distinctly phytophagous larvae, the other, numbering four specimens only, showed all the characteristics of

carnivorous larvae. Investigation proved that the latter group were, in fact, living at the expense of the former, piercing the skin of one after another of the phytophagous species, which proved to be *Chortophila pilipyga*, and sucking the body-contents. Certain Microlepidopterous larvae which were also present shared the same fate. It is evident then that *Phaonia trimaculata*, which has been considered a cabbage pest, is not phytophagous, but on the contrary serves the purpose of ridding the plant of serious enemies.

Myospila meditabunda, F., which was observed by the author in cow-dung and in the excrement of pigs mixed with various decaying vegetable matter, has been described by Portchinsky as being so much like the carnivorous *Mydaea ancilla* that the larvae of the two species were considered indistinguishable. *Myospila meditabunda* is undoubtedly carnivorous, feeding upon saprophagous larvae, as well as those of certain small Anthomyiids and Borborids which accompanied them.

The genus *Mydaea* includes several carnivorous larvae. The larvae of *M. ancilla* and *M. urbana* are undoubtedly carnivorous; those of *M. tincta* are probably so; the larvae of *M. pertusa* possess the morphology characteristic of carnivorous larvae; a larva of *M. vomiturationis* has been known to be the cause of a fatal intestinal myiasis. The larvae of *M. pici*, *M. anomala*, *M. torquans* and *M. spermophila* have been found as subcutaneous parasites of birds in central America.

Hydrotaea dentipes, F., has already been fully dealt with and the larvae proved to be carnivorous in their third instar, in the work of Portchinsky referred to above. This species is particularly important as preying on *Musca domestica* and *Stomoxys calcitrans*. The author's investigations have confirmed Portchinsky's discoveries. *H. armipes*, Fall., has also been described in the carnivorous larval stage by Portchinsky. *H. meteorica*, L., has been known to produce intestinal myiasis in human beings.

Muscina assimilis, Fall., is described as semi-carnivorous or omnivorous, as it can maintain life, in the absence of animal matter, upon vegetable matter in a state of decomposition. It is frequently found in decaying fungi or other vegetable matter, where it lives upon the larvae of such Diptera as *Drosophila confusa*, *Fannia canicularis*, L., and *Aphiochaeta rufipes*, Mg. *Muscina stabulans* and *M. pabulorum* have similar habits to *M. assimilis*. *M. stabulans* has been found capable of living for a long time in the intestinal liquid of man, and the larvae may cause serious injury by wounding the walls of the intestine with their sharp mouth-parts.

Portchinsky's account of the carnivorous habits of *Polietes albolineata*, Fall., and of *Mesembrina mystacea*, L., are discussed, as well as his work on *Hydrotaea dentipes*, regarded as an enemy of saprophagous larvae. The author agrees that carnivorous larvae, and in particular those of *H. dentipes* and *Muscina*, are an important factor in the destruction of the house-fly, but he does not agree with Portchinsky that this habit could be put to any practical use as a control method, since, if the breeding places of the fly are known, it is easier to destroy them or render them uninhabitable than to introduce the larvae of some carnivorous species into their midst. There is also the risk of introducing the carnivorous species into houses if freely distributed in the vicinity. It would be a decided advantage, however, to introduce

them into certain regions, such as the Russian steppes visited by Portchinsky, where they do not occur naturally and where *Musca domestica* and *Stomoxys calcitrans* abound.

RITCHIE (A. H.). **Report of the Government Entomologist for Year 1916-1917.**—*Supplement Jamaica Gazette, Kingston,* **xl**, no. 4, 5th July 1917, pp. 92–97.

Among sugar-cane pests in Jamaica, the most serious is *Stenocranus saccharivorus*, Westw. (cane-fly), which has been very abundant during the year under review. During the autumn rains the pest was kept in check by a fungus, which has been identified as a species of *Fusarium*. During early spring, however, the weather was dry and the adult hoppers consequently swarmed over the young cane unchecked, the stools soon becoming black with the *Meliola* fungus (sooty-mould) and the leaves pitted with egg-punctures. The fungus is at present the most effective check. Natural enemies include *Chrysopa* sp., the predaceous Reduviid, *Zelus rubidus*, Lep. and Serv., and a Syrphid. Ants are also predaceous enemies. In time, parasites which are an effective check in Porto Rico, including a Mymarid, a Dryinid and a Strepsipteron, may be introduced into Jamaica.

Coconut leaves have been blackened with sooty mould as a consequence of the attacks of *Cerataphis* sp. *Vinsonia stellifera*, Westw., was remarkably abundant. *Pseudoparlatoria ostreata*, Ckll., was abundant, but was heavily parasitised by the cinnamon fungus, *Verticillium heterocladum*, Penz. *Pseudococcus nipae*, Mask., also occurred. *Diaspis boisduvali*, Sign., was common in some districts on leaf-bases and *Pinnaspis buxi*, Bch., on leaves. *Strategus titanus*, F., is the common coconut beetle of the Island, but the trouble is spasmodic and the beetles are controlled by digging them out by hand or pouring into their burrows strong solutions of Jeyes' or carbolic dips. A Tachinid fly, *Sarcodexia sternodontis*, Towns., has on one occasion been bred from the beetle. *Xyleborus* sp. (pinhole borer) occasionally damaged palm-stems ; emulsions of carbolineum are used as a control. *Metamasius sericeus*, Oliv. (the brown weevil) is found in coconut plantations following upon diseased or wounded condition of the trees, and is also found infesting banana refuse in the fields. Trapping the adults is recommended to prevent the spread of disease through the agency of the weevil ; arsenate of lead, $2\frac{1}{2}$ lb. to 40 gals. of Bordeaux mixture, is suggested as a suitable spray.

Citrus trees suffer most severely from attack by *Aleurocanthus woglumi*, Ashby (spiny fly) ; this is rapidly becoming a general pest throughout the Island. An experiment with *Cremastogaster brevispinosa*, Mayr, in which these ants were colonised upon the citrus trees, has been very successful, the trees having become healthy and returned to bearing. Trees on which the ant colonies had not been introduced remained black and shrivelled and yielded no crop. Entomophagous fungi have not in any part of the island succeeded in creating an effective check, but Florida citrus spray is being used with good effect. Owing to the scarcity of potash-soap, the formula has been changed to : Hard soap, 2 lb. ; paraffin oil (26° to 28° Bé.), 2 gals. ; and 1 gal. water. The soap is cut into chips and all the ingredients heated to boiling point and churned with a force-pump. Natural insect controls include the Coccinellid, *Lioscymnus diversipes*, Ch., and

Chrysopa sp. A shipment of the Coccinellid, *Delphastus catalinae*, Horn, is to be sent during the summer from California, where it controls *Aleurodes kelloggi.* The scale-insect, *Fiorinia proboscidaria*, Green, has been recorded for the first time on citrus in Jamaica. The purple scale, *Lepidosaphes beckii*, was reported as abundant in one locality, but was checked by spraying. *Pachnaeus citri*, Mshl., sp. n., is a green weevil that has been found injuring citrus leaves.

Pimento trees have been dying out extensively. An investigation resulted in the Cerambycid beetles, *Cylindera flava*, F., and *Neoclytus longipes*, Drury, being bred from sickly and dead pimento wood. A new species of *Plectrothrips* was found in the tunnels of the Cerambycid larvae. The trunks and larger branches of pimento trees were heavily infested by a new species of armoured scale, *Odonaspis pimentae*, Newst., which prevented the normal shedding of the bark. No internal parasites have been bred out, but the scale is attacked by a black fungus (*Myriangium duriaei*) and the red-headed fungus (*Sphaerostilbe coccophila*). The soft scale (*Llaveia primitiva* var. *pimentae*, Newst., nov.) is found beneath the loose bark of pimento. A Cercopid (spittle insect) injures developing buds, blossom and berry clusters. Termites attack trees that have been damaged by storm or by careless fruit-pickers. Such damage should be repaired and all termite nests treated with white arsenic.

Pineapple was found to be attacked by a weevil new to science, *Metamasius ritchiei*, Marshall ; the borings made by this weevil cause the fruit to rot, the brown weevil, *M. sericeus*, Oliv., frequently attacking the fermenting pines. A suggested method of control is the digging out of infested plants and splitting them open so as to expose the immature stages to their natural enemies and to kill them by the drying out of the plants. *Diaspis bromeliae*, Kern. (pineapple scale) and *Pseudococcus bromeliae*, Bch. (mealy-bug) are found wherever pines are grown. Care should be taken to procure clean slips, and subsequently to control the attendant ants. Carbolic acid added to the citrus sprays is recommended as a wash for scale and mealy-bug, and as a repellent for the ants. Coccinellid larvae occur, and red spider is often troublesome at the leaf-bases, but is generally controlled by tobacco decoctions.

Insects attacking stored products include the larvae of the moth *Ephestia cautella*, Walk., in cacao beans and banana figs ; *Lasioderma serricorne*, F., in banana flour and in cigars.

Maize was considerably damaged by the hopper, *Peregrinus maidis*, Ashm. A Halticid, *Disonycha laevigata*, Jac., was found on maize without apparently causing any damage, but calulu was in one locality destroyed by this beetle.

Sweet-potato leaves were attacked by the Halticid, *Chaetocnema apricaria*, Suffr., and by the Cassidid, *Coptocycla flavolineata*, Latr. The destruction of wild or native Ipomoeas, on which the latter beetle feeds, is recommended. The scarabee, *Euscepes batatae*, Waterh., and the weevil, *Cylas formicarius*, caused some damage, as in previous years. Sanitation in the field, rotation of crops, etc., have been recommended. A weevil grub in sweet-potato tubers, which has caused much damage, is under observation. Occasional injury is caused to tubers by *Lachnosterna* grubs and to the vines by the soft scale, *Mesolecanium batatae*, Ckll.

Insects on truck crops include: on tomatoes, the bugs, *Loxa flavicollis*, Dru., *Euschistus crenator*, F., *Nezara marginata*, P. de B., *N. viridula*, L., and *Zicca taeniola*, Dall.; on cucurbit vines, the beetles, *Cerotoma ruficornis*, Oliv., and *Diabrotica theimi*, Baly. *Gryllus assimilis*, Walk., was a serious pest of seedling vegetables, which were also destroyed by a millepede, *Paradesmus coarctatus*, Sauss.

Bee-keepers are urged not to use box-hives and to avoid the importation of queens wherever possible, as preventive measures against the possible introduction of European or American foul-brood. The presence of the wax-moth (*Galleria mellonella*, L.) in the Island is ascribed to lack of sanitation in the majority of cases.

Coccids include *Palaecoccus rosae*, R. & H., on shade trees, where it is parasitised by a Chalcid, and on roses, which are also attacked by *Chrysomphalus ficus*, Ashm., and *C. dictyospermi*, Morg. *Aulacaspis pentagona*, Targ., occurred on papaw and heliotrope. *Pulvinaria cupaniae*, Ckll., injured imported mulberries, which however recovered after pruning and spraying with heavy oil emulsion. *Asterolecanium pustulans*, Ckll., from an akee tree injured cacao, cultivated fig and geraniums. *Pulvinaria pyriformis*, Ckll., infesting leaves of guava was attacked after the autumn rains by the parasitic fungus, *Cephalosporium lecanii*. *Pseudaonidia tesserata*, d'Emm., was abundant on Cromantee wattle (*Matayba apetala*), on ramoon (*Trophis racemosa*) and on rock sweet-wood (*Nectandra coriacea*), which also harboured *Aspidiotus cydoniae*, Comst. *Orthesia insignis*, Douglas (lantana bug) was found on coleus and chrysanthemums. *Hemichionaspis minor*, Mask., and *Saissetia hemisphaerica*, Targ., attacked *Asparagus racemosus*.

Miscellaneous pests include: *Pachyzancla phaeopteralis*, Gn., which in the case of severe outbreak denudes pastures and thus injures stock. The butterfly, *Agraulis* (*Dione*) *vanillae*, L., was reared from caterpillars defoliating sweet-cup (*Passiflora maliformis*). The Noctuid, *Xanthopastis timais*, Cram., destroys lilies, which should be dusted with arsenicals or the larvae hand-picked. *Oiketicus* sp. (almond bagworm) was found on *Terminalia catappa*, *Cupressus erectiviridis*, and roses, and when numerous is extremely destructive. The Amatid, *Eunomia rubripunctata*, was reared from caterpillars destroying the leaves of shade-vines of *Bignonia*. *Dysdercus andreae*, L. (cotton-stainer) occurred in enormous numbers at the maturing and bursting of the cotton-wood bolls. *Cosmopolites sordidus*, Germ. (black banana weevil) is being studied and controls discussed. A beneficial Elaterid grub (*Pyrophorus* sp.) was present in infested bulbs. A large flight of May bugs, found to be an undetermined species of *Lachnosterna*, occurred in late April and early May. *Cyclocephala tetrica*, Voet., and *Ligyrus fossor*, Latr., were also abundant at the same time.

GIRAULT (A. A.). **The North American Species of *Pachyneuron* with three New Species (Chalcid Flies).**—*Psyche, Boston, Mass.*, xxiv, no. 3, June 1917, pp. 88–90.

A key is given to the North American species of *Pachyneuron* and the following new species are described: *P. virginicum*, Gir., reared from wingless, viviparous females of *Aphis sorbi*, Kalt., on apple; *P. texanum*, Gir., reared from wheat; and *P. californicum*, Gir.

SHINJI (G. O.). **Notes on Aphids.**—*Psyche, Boston, Mass.*, xxiv, no. 3, June 1917, pp. 84–86.

Descriptions are given of *Nectarosiphum rubicola*, Oestl., occurring on thimbleberry (*Rubus parviflorus*), including a description of the male, and of *Chaitophorus coleoptis*, sp. n., occurring on *Abies balsami.*

QUAINTANCE (A. L) & GEYER (E. W.). **Life-History of the Codling Moth in the Pecos Valley, New Mexico.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 429, 28th February 1917, 90 pp., 17 figs. [Received 17th July 1917.]

The results of spraying operations in the course of investigations into the life-history and control of the codling moth in New Mexico have been described in a previous bulletin [see this *Review*, Ser. A, ii, p. 484]. The present paper gives the results of observations into the life-history during the years 1912–1915 and is supplementary to the former bulletin. The records of observations as to the number of generations, length of the life-cycle and its various stages during 1912 and 1913 are given in detail. A chart demonstrates the probable effect of sudden changes of temperature on the activities of the codling moth. Successful band records were made during 1913; these are given in the form of tables and curves.

MOORE (W.). **Toxicity of Various Benzene Derivatives to Insects.**—*Jl. Agric. Research, Washington, D.C.*, x, no. 11, 11th June 1917, pp. 371–381, 4 figs.

This paper has been abstracted in this *Review*, Ser. B, v, p. 131.

LEGISLATION.

Minnesota Nursery and Orchard Inspection Law. An Act Providing for the Inspection of Nurseries and Orchards. — *Minnesota Insect Life, St. Paul*, iv, no. 4, 1st July 1917, pp. 4–8.

The provisions of the amendment passed in 1917 to the Session Laws of 1913 are given verbatim. The amendment provides that the State Entomologist be appointed inspector of nurseries, his powers and duties being detailed, that all nursery stock brought into the State must be certified, a copy of the certificate to be filed with the Minnesota inspector, that shipments must be accompanied by a certificate of inspection, that transport of any uncertified stock must be refused by railroad and express companies, that foreign-grown stock imported into Minnesota must be inspected. Failure to comply with these regulations entails certain penalties under the law of 1905. An annual report is required from the State Entomologist.

NOTICES.

Secretaries of Societies and Editors of Journals willing to exchange their publications with those of the Bureau, are requested to communicate with the Assistant Director.

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Graf (J. E.). **The Potato Tuber Moth.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 427, 6th February 1917, 56 pp., 45 figs. [Received 17th July 1917.]

This bulletin contains much information on the life-history and habits of *Phthorimaea operculella* and is accompanied by a map showing its distribution. In California, all stages exist throughout the year, destroying the leaves of potato plants and tunnelling into the substance of the tuber. Every precaution should be taken to leave no tubers exposed for the insect to work on; they should never be left in the ground after they are ripe and where the soil is dry. Infested tubers should be fumigated with carbon bisulphide, using 2 lb. per 1,000 cubic feet of air-space and allowing 48 hours for the process. Infestation can be checked by keeping the potatoes in cold storage, at a temperature of 37° to 40° F.; this should only be resorted to as a temporary measure.

The following parasites are listed, with notes on their life-history and methods of parasitisation: *Dibrachys clisiocampae*, Fitch, *Sympiesis stigmatipennis*, Gir., *Campoplex phthorimaeae*, Cushm., *Apanteles* sp., *Habrobracon johannseni*, Vier., *Chelonus shoshoneanorum*, Vier., *Bassus gibbosus*, Say, *Microgaster* sp., *Nepeira benevola* var. *fuscifemora*, Cushm., and *Zagrammosoma flavolineatum*, Cwfd.

A bibliography of 96 works is given.

Bunker (P. S.). **Report of Superintendent of Gypsy and Brown-tail Moth Work.**—*Ann. Rept. Park Commissioners, City of Fitchburg, Mass, for 1916, Fitchburg*, 1917, pp. 51–56, 2 plates. [Received 17th July 1917.]

The process of thinning out the favourite host-trees of the gipsy moth [*Lymantria dispar*] and of the brown-tail moth [*Euproctis chrysorrhoea*] has been continued, increasing reliance being placed on this method in eradicating these pests, the other methods, in their order of efficacy, being spraying and hand-work. Conditions in the city as a whole, and particularly in those sections subject to human occupancy, which have received the most attention, are greatly improved regarding the prevalence of the moths since the previous report was issued [see this *Review*, Ser. A, iv, p. 325]. Natural causes have aided the suppression of gipsy moth, especially in the woodlands, where however wind-spread has been responsible for the scattering of a light infestation throughout those areas where non-resisting trees occurred in considerable numbers. It is intended in the ensuing year to continue the work of roadside thinning and the removal of non-resistant species in the belts connecting residential districts with the woodlands. Intensive spraying also will be carried out in business and residential districts.

The diminution in brown-tail infestation is most encouraging throughout the Commonwealth. Natural factors have combined to assist the active work of suppression, which, it is hoped, will be much less arduous in the coming year.

(C399) Wt.P5/131. 1,500. 10.17. B.&F.Ltd. Gp.11/3. A

Wildermuth (V. L.). **The Desert Corn Flea-Beetle.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 436, 7th February 1917, 23 pp., 1 plate, 7 figs. [Received 17th July 1917.]

Chaetocnema ectypa, Horn, occurs in the semi-arid areas of the south-western United States, where it attacks maize, sugar-cane, Sudan grass, wheat, barley and lucerne, its natural food-plants being apparently some of the native grasses. The larvae attack the plants below the ground, while the adults feed upon the leaves. The eggs are deposited at or near the surface of the ground and hatch in about six days. The larval stage lasts on an average 32 days, the larvae when mature pupating in the soil beside the roots. The length of the pupal stage is very variable, the total length of the life-cycle being about seven weeks. There are three or four generations in each year. Adults hibernate under rubbish, or about the base of grasses. Predaceous enemies include the nymphs and adults of the Hemipteron, *Reduviolus ferus*, L., which attack the adults; mites (*Pediculoides* sp.) have frequently been found on the beetles; the larvae and prepupae are preyed upon by a small Bethylid wasp, *Neurepyris* sp. The number of adult flea-beetles can be greatly reduced by cleaning up hibernation quarters and eradicating some of the weed host-plants, such as Johnson grass, salt grass and Bermuda grass. In moist soil the larvae pupate near the surface of the ground and within a few inches of the plant; careful cultivation after each irrigation will therefore destroy many pupae. Small areas can be treated successfully with a spray of 2 lb. arsenate of lead in 50 U.S. gals. water with strong soap in solution. This is both a repellent and a poison.

Hhpkins (A. D.) & Snyder (T. E.). **Powder-Post Damage by** *Lyctus* **Beetles to Seasoned Hardwood.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 778, January 1917, 20 pp., 13 figs. [Received 17th July 1917.]

Seasoned hardwood in North America is very liable to attack by *Lyctus* beetles, whose presence can be detected by the fine flour-like powder found on or beneath stored piles of hardwood products. When the wood is split open the interior is found to consist of a mass of closely-packed, powdery material, which has been held together by a thin outer shell of sound wood, in which the emergence holes of the adults can be seen. The white or sap-wood only is damaged, the beetles never attack the heart-wood. Varieties especially liable to this injury are hickory, ash and oak; other species less frequently attacked are persimmon, osage orange, black walnut, butternut, maple, elm, wild cherry, locust, poplar, sycamore, eucalyptus, sassafras, orange wood, fig and bamboo.

The species of *Lyctus* dealt with in this bulletin are: *L. planicollis*, Lec., of which the life-history and habits have previously been described [see this *Review*, Ser. A, iv, p. 324]; *L. linearis*, Goeze, which in life-history and habits closely resembles *L. planicollis*; *L. parallelopipedus*, Melsh., which attacks commercial products made from persimmon, hickory, ash, oak and bamboo, and also lives in the dead wood of osage orange, sassafras and fig; adults are active from mid-March to the end of August, general emergence being in June and July; and *L. cavicollis*, Lec., which is recorded from California in

commercial products, seasoned orange wood, hickory, tanbark oak and cordwood of live oak, the adults being active from April to mid-September.

Insect enemies of these powder-post beetles are Clerids, Histerids and Cucujids. Many species of small, Hymenopterous parasites also attack them, their emergence holes being much smaller than those of the beetles. These parasites are not sufficient to keep the beetles under control.

As a prevention against injury by *Lyctus*, material in yards and storehouses should be inspected annually, preferably in November and February and any showing evidence of infestation should be burnt. All wood in store should be classified and the oldest used first. The more valuable material should be treated between October and March with two coats of hot boiled linseed oil, which will render it immune to attack. The sapwood portions of cabinet work and furniture should be varnished or treated with paraffin wax, or any other substance which closes the pores of wood, in which the eggs are laid. Material once infested is generally useless and should be burnt. If slightly damaged, it should be treated by one of the methods given below, kept in quarantine for a time and perhaps re-treated. This should be done from October to March in storehouses and before 1st April in the open. The treatments suggested are :—(1) Immersion in or liberal applications with a brush of pure kerosene oil. (2) Similar treatment with any of the following mixtures applied hot : 3 parts creosote and 1 part kerosene ; 3 parts kerosene and 1 part creosote (to obtain deeper penetration) ; or 1 part creosote and 3 parts naphtha. (3) Steaming the wood under pressure. (4) Submitting the wood to temperatures over 200° F. in dry kilns. (5) Fumigation with sulphur dioxide.

French, Junr. (C.). **Two Destructive Insect Pests of Plane and Elm Trees in Victoria.**—*Jl. Dept. Agric., Victoria*, xv, no. 5, May 1917, pp. 308–310, 2 plates. [Received 18th July 1917.]

Maroga unipunctana, Don. (*Cryptophaga gigantella*, Walk.) (cherry borer moth) injures plane and elm trees in Victoria, the larvae boring tunnels into the limbs and penetrating to the heart of the tree. A sawdust-like excrescence on the bark shows where the caterpillars have been at work. This should be cleared away and a piece of rag soaked in carbolic acid should be plugged into the opening and closed over with clay or soap. The grubs can often be reached and destroyed by probing the tunnels with a piece of strong wire. The trees may be sprayed with coal-tar water, made by boiling 1 lb. coal-tar in 2 gals. water and adding 50 to 100 gals. of water before cooling.

The larvae of *Teia anartoides* (painted apple moth) eat the foliage of plane and elm trees ; they can be controlled by spraying with 1 lb. arsenate of lead to 25 gals. water.

Banana Borer.—*Jl. Jamaica Agric. Soc., Kingston*, xxi, no. 5, May 1917, pp. 169–173. [Received 18th July 1917.]

In a long Memorandum, dated 7th April 1917, the Commissioner of Agriculture for the West Indies, Sir Francis Watts, expresses the opinion that the black weevil borer of bananas [*Cosmopolites sordidus*], while capable of creating a certain amount of trouble in banana fields,

can be prevented from becoming a grave menace to the banana industry by careful cultivation. Under ordinary circumstances the attack of the weevil is directed to the bulb of the plant, eggs being laid on the surface of the bulb, below the ground-level,† the larvae penetrating into the bulb, where the life-cycle is completed, the whole cycle taking about a month. Observations and records all tend to show that those parts of the bulb are attacked where the tissues from some cause lack vitality. In every banana plant there is the old bulb present, the fruiting bulb and the sucker, and in almost every case of infestation the old bulbs, which are in a dying condition, are attacked, while there is little tendency for the grubs to penetrate into the more vigorous or actively growing bulb.* In badly infested districts under examination, the bananas were found to be in a badly neglected condition and infested with the fungus, *Marasmius semiustus*; in these circumstances the weevil attacks are much deeper and more extensive than in healthier districts, and even here the bulbs were generally attacked at the base. It is suggested that experiments should be made in a weevil-infested area, small plots being planted and thoroughly manured and cultivated against disease or injurious influences other than the borer, when it is hoped that marked resistance would be shown to weevil attack. Attention is drawn to the fact that the allied weevil, *Metamasius* (*Sphenophorus*) *sericeus*, which is found on bananas, was supposed to be a direct pest of sugar-cane, but careful investigation showed that the insect only attacks unhealthy and previously injured cane-tissue. In cases of deep-seated infestation of the bulbs, which will generally be found accompanied by *Marasmius* and imperfect cultural methods, it would be well to eradicate the bananas, which could be done under the advice of agricultural instructors. The destruction of the bulb-tissue would seem in that case to be of primary importance; this is probably best accomplished by cutting down and slicing up the stems in the usual manner and then digging up and slicing the bulbs, the slices being spread over the ground and stirred at intervals to promote decay. Eggs will probably be laid for preference on these slices, which must be cut the right thickness so that they will have decayed before mature weevils can develop in them. The insects might be attracted in such numbers as to make hand-collection advantageous. Growers should be careful to select only healthy planting material. The suggestion has been made that immersing banana bulbs in water for about 36 hours will kill all weevils present. If this simple remedy proves efficacious, growers should adopt the precaution. More knowledge is required concerning the natural enemies of the borer in Jamaica. The question of introducing a Histerid beetle from Java as a control is also being considered. Problems of dissemination of the pest and alternative host-plants also need elucidating. The views expressed in this memorandum are put forward tentatively and experimental evidence is desired before they can be regarded as conclusive.

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† Other observers state that eggs are usually laid in the stem several inches above the soil.—Ed.

* In the Congo, where this weevil has recently appeared and has destroyed considerable areas of bananas, M. Mayné found that it was the young plants that were chiefly attacked [see this *Review*, Series A, v, p. 364].—Ed.

Cradwick (W.). **Florida Citrus Spray.**—*Jl. Jamaica Agric. Soc., Kingston*, xxi, no. 5, May 1917, p. 185. [Received 17th July 1917.]

The author records good results obtained on grape-fruit trees by scrubbing and painting the larger stems in October with sulphate of iron mixture, followed by spraying with Florida Citrus spray (a proprietary article). The trees, which previous to this treatment had been covered with scale-insects, were apparently quite free from them when examined in December, but were covered with a crop of the beneficial red-headed fungus (*Sphaerostilbe coccophila*) and were in a perfectly healthy condition.

Copeland (E. B.). **Diseases and Pests of Sugar-Cane in the Philippines.** *Philippine Agriculturist & Forester, Los Baños*, v, no. 10, February 1917, pp. 343–346. [Received 25th July 1917.]

Insect enemies of cane include pests that attack the stem, the leaf and the roots. The Lamellicorn beetles include a species of *Heteronychus* similar to a destructive species found in Java and Hawaii. *Holotrichia vidua*, Sharp, is found both in Java and the Philippines. *Alissonotum pauper*, Burm., occurs only in the Philippines, although allied destructive species are found elsewhere. The larvae of the beetles *Apogonia* and *Adoretus* have been found on newly-furrowed sugar lands and probably damage the roots of sugar-cane, as they are known to do elsewhere. Among moths, *Diatraea venosata* (*striatalis*) and *Scirpophaga* are both pests of sugar-cane, as in Java. Several species of termites attack newly-planted cane. Locusts are the most abundant leaf-pests, the stretches of waste land throughout the Islands making these insects difficult to control. Cane-hoppers include *Perkinsiella vastatrix*, and the two endemic species, *P. saccharivora* and *P. pseudosinensis*. *Proutista moesta*, Westw., is dangerous owing to the fact that rust and leaf-spot diseases so often accompany its attacks. Another hopper, *Brixiodes carinata*, occurs in small numbers. *Tropidocephala saccharivorella*, a Formosan leaf Delphacid, has recently been found. *Oregma lanigera* is a destructive plant louse found in almost all sugar regions. The scale, *Dactylopius sacchari*, and the larvae of the moth, *Spodoptera mauritia*, feed on the leaves. A number of other plant lice have been found on sugar-cane but are not known to be destructive. A species of *Tetraneura* attacking cane-roots is probably identical with a species which destroys rice-roots in Java. Mole-crickets are known to damage the roots of cane. As *Saccharum spontaneum*, which is either the wild form of sugar-cane or a closely-allied species, is a common wild grass in the Philippines, it is not surprising that the majority of the serious pests of sugar-cane are to be found in the Islands. For the same reason, however, the natural parasites of these pests are indigenous to the Islands and prevent the depredations of the insects attaining the importance which they otherwise would. Open planting and good cultivation would certainly act as a great check to the pests of sugar-cane in the Philippines.

Headlee (T. J.). **The Hessian Fly.**—*New Jersey Agric. Expt. Sta., New Brunswick*, Circ. no. 46, 8 pp. [n. d.]. [Received 25th July 1917.]

In this paper a popular account is given of the life-history of

Mayetiola destructor. There are two main broods in a year, one in the spring and the other in autumn. Under exceptionally moist weather conditions a supplementary spring brood may follow the main brood, a summer emergence may occur on self-sown wheat, and a second autumn brood may follow the first one. The controls advised are proper preparation of the seed-bed, including the liberal use of good fertiliser, and correct time of seeding, which can be calculated for any point in the State. A table is given for determining the date of safe sowing at various altitudes and in various latitudes.

Beeson (C. F. C.). **The Life-History of *Diapus furtivus*, Sampson.**—*Indian Forest Records, Calcutta,* vi, no. 1, 1917, 29 pp., 2 plates. [Received 25th July 1917.]

Diapus furtivus, Sampson, is apparently distributed uniformly throughout the sal forests of the Sub-Himalayan tract and of Central India. Investigations carried out during the years 1913–1915 indicate that the insect is not primarily responsible for the dying off of *Shorea robusta* (sal), but is one of a number of shot-hole borers which attack trees that already have diseased roots. Its attacks on healthy trees are practically without any effect, and are not fatal to trees weakened by defoliation, creepers, local conditions, etc. The insect breeds chiefly in newly dead or felled trees and is active throughout the year. The length of the life-cycle is usually about 10 weeks, but owing to the prolonged egg-laying period, emergence is extended over a period of five or six weeks. It is impossible to determine the minimum number of generations in the field; all stages of the insect are found throughout the year and there are no marked swarm periods. The borers construct a system of galleries in the sap-wood and heart-wood of sal, the larvae feeding on an ambrosia fungus which grows on the walls of the brood galleries. The wood-dust produced by the boring is ejected by the male beetle from the tunnel entrance.

Several species of Cucujids, Colydiids, etc., are predaceous upon shot-hole borers of sal, but to what extent they attack *D. furtivus* has not yet been discovered. Many of the predaceous species cannot enter the galleries of the borer, owing to their size. The Clerid, *Tillicera assamensis*, Stebb., is said to prey upon *D. furtivus* in Assam, and two species of *Stigmatium*, at present unidentified, attack the borers when swarming. The Curculionids, *Phaenomerus sunderwalli*, Boh., and an unknown species of the same genus have been found several times in galleries of *D. furtivus*, apparently feeding on dead borers; and a species of Chalcid, at present unidentified, has been bred from *D. furtivus* broods. The red tree-ant, *Oecophylla smaragdina*, F., is an important enemy of the beetle, a sal tree around which beetles are swarming being usually occupied by an army of these ants. Parasitic Nematode worms have been found in the bodies of several beetles.

The damage effected by the beetles takes the form of shot-holes and lines and stained wood defects, the sale price of infested timber being materially affected. The remedies suggested are early barking on felling areas and the removal of newly-dead trees in other parts of the forest.

Chatterjee (N. C.). **Forest Entomology.**—Reprint from *Ann. Rept. Bd. Scientific Advice for India, 1915–16, Calcutta* [n. d.], Economic Zoology, pp. 1–4. [Received 25th July 1917.]

Sal insects which have been under observation during the year include some 25 species of Scolytids; the economic status of most of these borers has been worked out. An account of *Hoplocerambyx spinicornis*, which has been reared from the egg in the insectary, will be published shortly. The life-history of the sal Longicorn, *Aeolesthes holosericea*, F., is under observation.

Teak insects are being studied and notes collected on their life-histories, including the Cossid moth, *Duomitus ceramicus*, Wlk., and the Longicorn beetle, *Haplohammus cervinus*, Hope.

Insects attacking sundri (*Heritiera fomes*) include five species of Longicorn and Buprestid beetles; three species of Platypodid shot-hole borers, which are the only serious pests of sundri, none of them being able however to attack a perfectly healthy tree; and three species of Scolytid pin-hole borers.

The chir pine scale-insect, *Ripersia resinophila*, Green, is being studied, and measures for checking the increase of this pest have been devised. The seasonal history of the toon shoot borer, *Hypsipyla robusta*, Mo., has been studied and an account of it is being prepared for publication. Sack-banding the older trees and early pruning in plantations have proved efficient methods of control. Reports of various pests include *Polygraphus major*, Steb., on *Pinus excelsa* and on *P. longifolia*; *Crossotarsus* sp. and *Cryptorrhynchus* sp., also on *Pinus longifolia*; *Protaetia neglecta* on deodar seedlings; *Scolytus* (*Eccoptogaster*) *major*, Steb., *Ips ribbentropi*, Steb., *Scolytus deodara*, Steb., *Crossotarsus* sp., *Cryphalus* sp. and *Tetropium oreinum* have all been recorded on deodar; *Myllocerus* sp. were found on shisham leaves; *Monophlebus stebbingi* on shoots of sal and a Prionid larva on the roots. Pyralid, Cossid and Longicorn larvae have all been found on culms of ulla grass, and a Microlepidopterous larva on jamun leaves. A species of Coccid, an unknown Lamiid borer and specimens of *Zeuzera coffeae* have all been recorded on sandal saplings. *Ingura subapicalis* was found defoliating sal; grubs of *Oryctes rhinoceros* damaged teak in a nursery. *Caryoborus* sp. were found infesting seeds of *Acacia donaldi*; caterpillars of *Hyblaea puera* defoliated plantation teak. Geometrid, Lymantrid and Bombycid larvae defoliated khair and sissoo (*Dalbergia sissoo*), and an unknown Prionid larva attacked the latter. An Aphid of the species *Lachnus* damaged *Michelia excelsa* in plantations. *Xyleborus discolor* and *X. interjectus*, Bldf., have been found attacking the branches of *Mesua ferrea*. *Metanastra latipennis* and *Lebeda nobilis*, Wlk., defoliated Khasya pine; *Haplohammus cervinus*, Hope, damaged teak stems. Weevils attacking teak saplings proved to be *Alcides ludificator*, Fst. A Cerambycid beetle, near *Pachydissus parvicollis*, Gahan, was bred out from the heart-wood of *Xylia dolabriformis*. A weevil, *Tanymecus* sp., severely damaged leaves of *Bombax malabaricum*, and *Protocerius grandis*, Guér., attacked *Phoenix paludosa*.

D'EMMEREZ DE CHARMOY (D.). **Moth-Borers affecting Sugar-Cane in Mauritius.**—*Dept. Agric. Mauritius, Port Louis,* Scient. Series. Bull. no. 5, October 1916, 27 pp., 6 plates. [Received 26th July 1917.]

The borers affecting sugar-cane in Mauritius include the Noctuid, *Sesamia vuteria*, Stoll (pink borer), which is distributed throughout the Island and is particularly abundant where certain graminaceous weeds are prevalent; these should always be buried after weeding and not left exposed to the borer. The eggs are laid beneath the leaf-sheaths of these weeds and here the larvae tunnel into the stems and do not attack the sugar-canes until a later stage of development. The best remedy is to keep the fields free from weeds, but other methods suggested are cutting out the borers at the first sign of infestation, rotation of crops and growing of catch-crops, such as tomatoes, potatoes and *Canavalia* beans between the rows, or the planting of trap-crops such as maize. Straw-burning is not recommended. The Pyralid, *Diatraea venosata* (*sacchariphaga*, Bojer) is a less serious pest. Eggs are laid on various parts of the plant and the tunnels made by the larvae considerably weaken the canes. Means of control are the same as those suggested for the pink borer; cutting out of the borer should be practised in virgin canes during the summer, when the insect is most abundant. Natural enemies common to both these species are *Telenomus* sp., *Trichogramma australicum*, *Henicospilus mauritii* and *H. antancarus*, all of which are described.

The Tortricid, *Argyroploce schistaceana* (white borer), oviposits on the blade or sheath, the young larva crawling down and entering the underground portion of the shoot, whence it constructs an ascending spiral gallery to the heart and then tunnels downwards again to the outside where the cocoon is spun. The borer should be cut out by severing the shoot as near as possible to its point of attachment to the stool. This should be done once a week as long as infection lasts, and the cut-out shoots should be at once burned or buried. *Trichogramma australicum* parasitises the eggs of the borer.

The Tineid, *Alucita sacchari* (brown borer), is frequently found in galleries abandoned by other borers, and is very injurious in young plantations reared from cuttings that have begun to ferment. Cuttings so affected should either be discarded or they may be soaked in a kerosene and soap emulsion for 24 hours before planting.

The larvae of *Diatraea venosata* are attacked by *Apanteles simplicis*, Vier. A Tachinid fly is occasionally known to parasitise the cocoons, which are attacked also by various mites. Several predators are useful auxiliaries in control, such as ants, musk-rats, tenrecs, partridges, minahs and lizards. The big lizard, *Galeote versicolor*, was imported from Réunion, where it is considered an efficient enemy of the borer.

LIMA (A. da Costa). **Considerações sobre a Campanha contra a Formiga Saúva.** [Note on the Campaign against *Atta sexdens*, **L.**]—*A Lavoura, Rio de Janeiro,* xxi, no. 2–4, February-April 1917, pp. 3–8, 3 figs. [Received 1st August 1917.]

Clayton gas and liquid sulphurous anhydride have proved useful against the leaf-cutting ant, *Atta sexdens*, L. The author condemns

the proposal to introduce another ant, *Prenolepis fulva*, as a means of controlling this insect [see this *Review*, Ser. A, v, p. 235].

De Bessenbladwesp, *Pteronus ribesii*, **Scop.** (*Nematus ventricosus*, **Latr.**) [The Currant and Gooseberry Sawfly.]—*Instituut v. Phytopatologie, Wageningen*, Vlugschrift no. 17, May 1917, 6 pp.

Energetic measures against the first generation of *Pteronus ribesii*, Scop., will limit the damage done by the second. In warm summers a third generation of this sawfly occurs, which is the least harmful, but needs control on account of the infestation it gives rise to in the following year. The best remedy is spraying with 0·5% lead arsenate or 1% Paris green in Bordeaux mixture, milk of lime, or water. As samples of Paris green are often entirely free from arsenic, Urania green is recommended in place of it. A solution containing about $\frac{1}{10}$ oz. of American or Persian insect powder in $1\frac{3}{4}$ pints of water may be used, or the bushes may be dusted with either of these powders. Lime or tobacco may also be used for dusting and quassia-soap solution for spraying. On a small scale it is possible to use cold water alone; for if the spray is sufficiently powerful, it will cause the larvae to drop to the ground, where they may be collected on sheets, etc., while if the ground has been heated by the sun many will die on that account.

Cheimatobia brumata and *Abraxas grossulariata* may be controlled by spraying with 6–8% carbolineum, *C. brumata* being also checked by banding.

Ritzema Bos (J.). **Het Stengelaaltje** (*Tylenchus devastatrix*) **en de tegenwoordig in de Bloembollenstreek heerschende aaltjesziekte der Narcissen. I.** [*Tylenchus devastatrix* and the Eelworm Disease of Narcissi now occurring in the Flower-bulb District.]—*Tijdschr. Plantenziekten, Wageningen*, xxiii, no. 3, June 1917, pp. 99–135.

Of late years a disease of narcissi has broken out in the Dutch bulb district with such violence as to be a serious menace to their cultivation. *Tylenchus devastatrix* (bulb eelworm) causes this disease, which is far more serious than the disease in hyacinths due to the same Nematode. The appointment in April 1917 of a Government investigator seemed a fit opportunity for recording the author's observations. This first part of the paper deals with *T. devastatrix* in general. This Nematode is able to live and multiply in a very large number of plants, but tends to adapt itself to particular species; under certain circumstances, it can remain without feeding or showing signs of life while retaining the faculty of becoming active again under more favourable conditions. A list of 68 food-plants is given, and this is believed to be incomplete. Though some plants are more susceptible to attack than others, it is generally the case that this Nematode has a marked preference for the plant in which it has lived for generations. This is of great practical importance and explains why peas and garden beans are almost uninjured in infested ground where rye and oats always suffer. In some districts where *T. devastatrix* lives in red clover or lucerne, other plants are not much attacked, and this explains why Havenstein and Kühn supposed the clover eelworm

to be a different species. The author does not consider the differences between the eelworm in clover and that in rye to be sufficient to make this distinction, though in Groningen the clover eelworm behaves as a physiological race specially adapted to clover.

Rutgers (A. L. L.). **Onderzoekingen over het ontijdig afsterven van peperranken in Nederlandsch-Indië. I. Overzicht der vroegere onderzoekingen. II. De pepercultuur op Banka.** [Investigations on the premature Dying-out of Pepper Vines in the Dutch East-Indies. I. Review of previous Investigations. II. Pepper Cultivation in Banka.]—*Meded. v. h. Laboratorium voor Plantenziekten, Buitenzorg*, no. 18, 1915, 28 pp. & no. 19, 1916, 36 pp., 24 plates. [Received 31st July 1917.]

Detailed accounts are given of pepper cultivation in the Dutch East Indies, including Banka, from which island 3,041 metric tons of black and white pepper, worth over £200,000, were exported in 1913. The premature dying-out of the pepper vines there is due to diseases and various pests, which latter include the Nematode, *Heterodera radicicola*, Greef., a Lamellicorn (*Holotrichia* sp.), a weevil, termites, a boring larva, and scale-insects, believed to be *Pseudococcus citri*, Risso, and *Ceroplastodes cajani*, Mask.

van Hall (C. J. J.). **Ziekten en plagen der Cultuurgewassen in Nederlandsch-Indië in 1915.** [Diseases and Pests of cultivated Plants in the Dutch East Indies in 1915.]—*Meded. v. h. Laboratorium voor Plantenziekten, Buitenzorg*, no. 20, 1916, 47 pp. [Received 31st July 1917.]

Potatoes were attacked by a Coccinellid beetle, *Epilachna* sp. The foliage of *Arachis hypogaea* was injured by leaf-eating caterpillars and by nocturnal subterranean larvae, which were controlled by collection after flooding had driven them to the surface.

Cacao suffered from *Helopeltis*, cacao moth [*Acrocercops cramerella*], borers, *Plagiolepis longipes* (gramang ant) and Lamellicorn beetles. Only slight injury was caused by Chrysomelid beetles, Curculionids and locusts. Teak woods were infested by *Cyrtacanthacris nigricornis*, Burm., but suffered little from this locust, which, however, spreads from them to neighbouring plantations of *Hevea*, *Castilloa*, *Ficus elastica*, dadap, coffee, cacao, etc. Teak was also injured by *Coptotermes* sp. and by the Cossid, *Duomitus ceramicus*, Wlk. *Ficus elastica* was only slightly injured by borers. The infestation of *Hevea* by *Cyrtacanthacris nigricornis* has spread, but it is hoped that the increase of this insect's natural enemies, including an Ichneumonid, *Scelio* sp., and the fungus, *Metarrhizium anisopliae*, will check it. *Hevea* infested by *Coptotermes gestroi* did not appear to be damaged. The increase of the ant, *Oecophylla smaragdina*, was so great on some estates as to prevent tapping. Kapok has been injured by the Noctuid, *Mudaria variabilis*, Rpke.

Cinchona pests included *Helopeltis antonii*, *Euproctis flexuosa*, *Attacus atlas*, *A. ricini*, *Cricula trifenestrata*, *Odonestis plagifera*, *Metanastria hyrtaca*, *Daphnis hypothous*, and *Hyposidra* sp.

Coconuts were injured by *Melissoblaptes rufovenalis*, Lucanid beetles, *Oryctes rhinoceros*, *Rhynchophorus ferrugineus*, Psychid moths, *Brachartona catoxantha*, *Hidari irava*, *Aleurodicus destructor* (?), and locusts.

Coffee was attacked by *Coccus viridis*, *Pseudococcus* (*Dactylopius*) *adonidum*, *P. virgatus* (*bicaudatus*), *P. citri*, *Brachytrypes* sp., *Xyleborus coffeae*, and *Zeuzera coffeae*. Mahogony was attacked by borers, *Xyleborus*, and *Attacus atlas*. Leaf-eating caterpillars injured maize. Pepper was attacked by the pepper weevil. Bananas were damaged by *Nacoleia* (*Notarcha*) *octosema*, Meyr. *Cecidomyia* sp., *Cirphis unipuncta*, locusts, and Lepidopterous borers infested rice, the last-named causing very serious injury [see this *Review*, Ser. A, iv, p. 85].

Sugar-cane was attacked by borers, especially in the case of plants the growth of which had been hindered by bad soil and by disease. Tobacco pests included *Prodenia litura*, *Agrotis ypsilon*, *Heliothis* (*Chloridea*) *obsoleta*, *Phytometra* (*Plusia*), thrips, Aphids, *Opatrum depressum*, *Lasioderma serricorne*, and tobacco moth.

Tea pests included *Helopeltis* [see this *Review*, Ser. A, v, p. 413], Psychids, *Parasa lepida*, leaf-rollers, *Brevipalpus oboratus* and other mites, Nematodes, and the caterpillars of *Cania bilinea*.

Section iv of this report lists and briefly describes the phytopathological literature published in 1915 concerning the Dutch East Indies.

RIJKS (A. B.). **Rapport over een Onderzoek naar de Pisangsterfte op de Saleiereilanden.** [Report on the Banana Disease in the Saleyer Islands.]—*Meded. v. h. Laboratorium voor Plantenziekten, Buitenzorg*, no. 21, 1916, 16 pp., 3 plates. [Received 31st July 1917.]

In this report mention is made of the injury done to coconut palms in the Saleyer Islands, lying between Celebes and Flores, by an Aleurodid believed to be *Aleurodicus destructor*, Mackie. The fungus, *Pestalozzia palmarum*, is another enemy of coconuts in this locality.

TRABUT (—). **Culture du Cotonnier en Algérie.** [Cultivation of Cotton in Algeria.]—*Bull. Agric. Algér. Tun. Maroc., Algiers*, xxiii, no. 6, June 1917, pp. 113–127, 8 figs.

The cultivation of cotton is discussed and in the latter part of the paper attention is drawn to the chief diseases and insect pests of cotton, for the information of Algerian growers.

LAMONT (Sir N.). **Notes on the Moth,** *Automeris janus*.—*Bull. Dept. Agric., Trinidad & Tobago, Port-of-Spain*, xvi, no. 1, 4th May 1917, p. 21, 1 plate. [Received 25th July 1917.]

Automeris janus is one of the most beautiful moths of Trinidad, where the larva is found during February on cacao and Bois immortel (*Erythrina*), but is prevented from becoming a serious pest in the island owing to the attacks of a Tachinid fly, *Willistonia esuriens*. Of 24 larvae reared by the author, no less than 23 were killed by this fly.

Mosher (F. H.) & Clement (G. E.). **Some timely Suggestions for the Owners of Woodlots in New England.**—*U. S. Dept. Agric, Washington, D.C.*, 1917, 8 pp. pamphlet.

This paper points out to farmers, etc., in New England the opportunity that has arisen for getting rid of classes of timber not ordinarily marketable, while prices are high and the demand for cordwood has increased, and for replacing felled timber with varieties which will lessen the liability of attack by gipsy moth [*Lymantria dispar*]. The susceptibility or otherwise to gipsy moth attack of the various species most usually grown has been discussed in a previous paper [see this *Review*, Ser. A, iii, p. 668]. Those species that form the favourite food-plants of the gipsy moth should be removed and the woodland should be kept stocked with valuable species chosen from those varieties that do not favour the increase of this pest.

Weiss (H. B.). **The More Important Greenhouse Insects.**—*New Jersey Agric. Expt. Sta., New Brunswick*, Bull. no. 296, 31st May 1916, 42 pp., 35 figs. [Received 25th July 1917.]

This bulletin has been prepared for the information of New Jersey florists. The author enumerates the principal greenhouse insects occurring in the State, with a description of the life-history, food-plants, injury, and methods of control in each case [see this *Review*, Ser. A, iv, pp. 204 and 452]. Many species of Coccids are dealt with and scale-insect remedies are discussed. Recommendations for fumigation are given, with detailed directions for the use of hydrocyanic acid gas.

Howard (L. O.). **An Active Ant-killer (Arach. Solpugid.).**—*Entom. News, Philadelphia*, xxviii, no. 7, July 1917, p. 310.

A specimen of the Solpugid, *Eremobates magnus*, Hancock, was forwarded to the author, having been found destroying large-sized ants. On being taken to an ant-hill this spider is said to have destroyed hundreds of the ants in a few minutes. As these ants are a great pest of freshly planted seeds at San Diego, where the Solpugid was discovered, it is suggested that the propagation of this important ant enemy would be advantageous.

Jones (D. W.). **The European Earwig and its Control.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 566, 18th June 1917, 12 pp., 8 figs.

Forficula auricularia, L., was introduced into Newport, R.I., in 1911, and though not of serious economic importance in Europe, it has increased so rapidly in Newport as to cause great annoyance. Eggs are laid in the ground, where the young larvae live in the day, coming at night to the surface about 5th May and feeding on tender green shoots of grasses and other plants. The adults feed on the petals and stamens of flowers, until cold weather sets in, when they descend into the ground from 2 to 8 inches and there hibernate. Natural enemies include a parasitic worm, *Filaria locustae*, which has been observed in the laboratory to cause the death of 10 per cent. of the earwigs. This is the only natural enemy existing in Newport which is of any

importance in control. A poison-bait composed of white bread-crumbs, 16 lb., Paris green, 1 lb., and sufficient water to moisten, spread broadcast over lawns and gardens just before dark, gives good results. This should be repeated at intervals of three or four nights from 15th May to 15th June. Plants that show earwig injury should be sprayed with a solution of 6 lb. arsenate of lead in 50 U.S. gals. water, the young leaves being covered with the spray. If the earwig attacks persist during the summer, a contact spray of nicotine, soft soap and water should be used over the plants every three nights after 1st July until the pest is controlled. Traps formed of inverted flower-pots placed every 10 or 12 ft. along borders or near vines catch a number of individuals which can be shaken out over a pail of kerosene and water.

HEARST (W. H.). **Report of the Minister of Agriculture, Province of Ontario, for the Year ending 31st October 1916,** *Toronto,* 1917, 84 pp., with photographs. [Received 27th July 1917.]

In the fruit branch, nurseries and orchards have been systematically inspected, and fumigation of all nursery stock from scale-infested districts was carried out. In every case where San José scale [*Aspidiotus perniciosus*] was reported from a fresh district the provincial inspector was sent to the locality to advise and demonstrate methods of control. Apiary inspection has resulted in better conditions of bee-keeping. Orchard experiments with dust instead of liquid sprays are considered to have given very favourable results, in many cases showing equal effectiveness and a saving of time. Further experiments are, however, necessary before definite conclusions are reached. For San José scale and oyster-shell scale [*Lepidosaphes ulmi*], a liquid is still found to be necessary for the dormant spray. The extension of these experiments to vegetable growing indicates that much work in this respect can be advantageously carried on in the coming year.

METCALF (Z. P.). **The Southern Corn Bill-Bug.**—*North Carolina Agric. Exten. Service, Raleigh, N.C.,* Circ. no. 19, August 1916, 21 pp., 13 figs. [Received 30th July 1917.]

This is a popular bulletin containing an account of the life-history and destructiveness of the corn bill-bug [*Sphenophorus callosus*]. [See this *Review*, Ser. A, i, p. 262.] Direct methods of control are difficult, owing to the hardiness of the insect and to its habit of living either in the maize-stalks or in the ground. The following factors in control are discussed, no one of them in itself being efficient, but when taken together checking the damage to a considerable extent: proper drainage and fertilisation of the ground, planting before the middle of April, ridging, thorough cultivation, autumn and winter ploughing, destruction of native food-plants, and rotation of crops.

GILLETTE (C. P.) & LIST (G. M.). **Insects and Insecticides.**—*Colorado Agric. Expt. Sta., Fort Collins,* Bull. no. 210, October 1915, 55 pp., 35 figs. [Received 11th August 1917.]

This bulletin gives a short account of the insects commonly found in Colorado injuring fruit, orchard and shade trees, and shrubs, with

recommendations for the control of each. A list of these insects is arranged according to the host-plants and the type of injury. Among the lesser-known pests are *Coccotorus prunicida*, Walsh (plum gouger), which is one of the worst pests of native plums in Colorado. The beetles puncture the skin of the fruit and deposit their eggs in the holes ; the larva then eats into the pit, destroying the seed. Pupation takes place in the seed, the adults appearing about the time the fruit matures and hibernating in the soil. The measures recommended are shaking the trees in the early morning from the date of opening of the blossoms and spraying with arsenate of lead soon after the blossoms fall and again 10 days later.

A native sawfly, *Gymnonychus appendiculatus*, Hartig, attacks the foliage of currant and gooseberry. There are two generations, one appearing in June and the second in August. Eggs are laid in the edge of the leaf between the two outer layers. The sprays recommended are 4 lb. arsenate of lead or 1 lb. Paris green in 100 U.S. gals. water, used before the fruit is picked. White hellebore, 1 oz. to 3 U.S. gals. water, may be used on the fruit or, in the evening, hellebore or pyrethrum dusted on the leaves.

Strawberry pests include *Ancylis comptana*, Frol. (leaf-roller), of which the larvae web the two edges of the leaf together and feed within the roll. Arsenate of lead, 5 lb. to 100 U.S. gals. water, should be applied before the leaves are rolled, or about one week after the moths appear in the spring. After the fruit is gathered straw should be scattered over the plants and burnt. The Nematode, *Tyloderma fragariae*, Riley, eats into the crowns of the plants. This is particularly a pest of old beds. When badly infested, one crop only should be gathered before renewing and new beds should be placed at some distance from the old ones. Burning straw is again recommended.

The Agaristid moth, *Alypia octomaculata*, F. (eight-spotted forester) attacks grape foliage. Arsenical sprays are recommended ; hand-picking might also be practical.

The sawfly, *Eriocampoides* (*Endelomyia*) *rosae*, Harr., in the larval stage eats the upper surface of rose-leaves. Sprays of white hellebore, arsenate of lead, black leaf 40, or dust sprays of freshly slaked lime or wood ashes will kill many larvae, or they can be washed from the leaves with a strong stream of water.

The second part of the paper gives formulae and instructions for the preparation of many insecticides, including poisons, contact sprays, poison vapours, and repellents and insect traps. The methods and apparatus used are described.

Flour Mill Insects.—*Wkly. Press Bull. Penns. Dept. Agric., Harrisburg,* ii, no. 29, 19th July 1917.

It is suggested that by equipping a mill with a steam heating system, adequate for heating the mill to 60° F. in winter, the temperature can be raised to 130° F. if the steam be turned on for 24 or 36 hours in warm weather in June or September. This temperature, maintained for four or five hours, should kill all stages of the Mediterranean flour moth [*Ephestia kühniella*] and other insects infesting flour-mills.

HEWITT (C. G.). **The Discovery of the European Ermine Moth** (*Yponomeuta*) **on Nursery Stock imported into Canada.**—*Agric. Gaz. Canada, Ottawa*, iv, no. 7, July 1917, pp. 552–554, 1 plate.

Hyponomeuta malinellus and *H. padellus* were first discovered in Canada in May 1917 in a shipment of shrubs and fruit seedlings from France, and these pests were immediately scheduled under the Destructive Insect and Pest Act. Their economic importance in Europe is discussed in this paper, and the necessity for continued vigilance against them in Canada is emphasised. The habits of the insect in France are recorded.

GIBSON (A.). **White Grub Investigation—A brief Report of Progress.** —*Agric. Gaz. Canada, Ottawa*, iv, no. 7, July 1917, pp. 554–556, 2 figs.

White grubs, which caused widespread injury in Canada in 1915, matured in the early summer of 1916 and changed to the adult stage in August. By careful observations during that time important flights of the beetles were predicted for 1917, these flights occurring chiefly in eastern Canada. *Lachnosterna fusca* and *L. dubia* were particularly abundant, and it is hoped to rear some important insect parasites from the collected specimens. In fields which were badly infested with young grubs in 1917, it will be unsafe to plant potatoes or maize in 1918, though a small grain or clover crop might be grown.

FITZSIMONS (F. W.). **Our Native Birds : their Value to Man.**—*S. Afr. Jl. Sci., Cape Town*, xiii, no. 8, March 1917, pp. 366–372. [Received 2nd August 1917.]

This paper points out the very considerable importance of birds in the economy of nature. After discussing the ravages of insect pests on the vegetation of the world, the author remarks that in order to obtain reforms for the protection and betterment of the human race it is usually found necessary to employ compulsion in the form of legislation.

In South Africa, if the native birds were exterminated, the human population would, in a few years, be reduced to a condition of starvation, while the ticks would destroy the domestic animals throughout the country. All natural checks to insect increase, including parasites, diseases and fungi, acting together with man's fight against the pests, are considered entirely inadequate, without the aid of birds, to prevent insects from sweeping all vegetation from the face of the earth. Of the 900 odd species of native birds in South Africa, not more than a dozen can be said to be harmful to man without sufficient redeeming qualities from an economic point of view to justify their preservation. Several instances are related of the serious consequences resulting from the indiscriminate destruction of wild birds, which inevitably causes disaster to mankind.

Parrott (P. J.), Hodgkiss (H. E.) & Lathrop (F. H.). **Plant Lice Injurious to Apple Orchards. ii. Studies on Control of Newly-Hatched Aphides.**—*New York Agric. Expt. Sta., Geneva,* Bull. no. 431, March 1917, pp. 33–79, 1 plate, 4 figs. [Received 3rd August 1917.]

This paper, which is a continuation of an earlier one [see this *Review,* Ser. A, iv, p. 273], records the results of further studies in the life-history of the apple Aphids, *Aphis sorbi* (rosy aphis), *A. pomi* (green aphis) and *A. avenae* (oat aphis), and of experiments for the development of more efficient spraying against them. At the beginning of the infestation in 1916, the oat aphis was the most abundant in the majority of orchards. The relative abundance of the three species exhibits a seasonal cycle which, while probably varying somewhat from year to year, appears to be fundamentally constant.

Experiments were made in artificially infesting certain fruit-clusters with examples of each of the three species, these clusters being encased in bags, while others were kept free from any infestation in a similar manner, as a control. Both *A. sorbi* and *A. pomi* severely damaged young foliage, while the infestation of *A. avenae,* although severe, was less lasting and showed very little injury to the fruit. The attack of *A. sorbi* was found to increase the number of fruit-clusters, the fruit however dropping before it was ready for picking. Fruit that suffered from the attacks of *A. pomi* was frequently contorted and dropped from the tree. All infestation resulted in diminution in the size of the fruit, the attacks of *A. sorbi* being the worst in this respect. A graph shows the comparative growth of normal and infested apples.

Spraying experiments with a mixture of $\frac{3}{4}$ pint nicotine (40%) to 100 U.S. gals. lime-sulphur solution (1 to 8), applied as a delayed dormant spray in May, revealed the susceptibility of the rosy aphis and the oat aphis to this form of spray. The trees so treated were free also from the green aphis until June, when there was a re-infestation due to invasion by winged migrants. The results of these, as well as certain auxiliary experiments, are given in tables. Further experiments are advised with this delayed dormant spray, which is postponed until after the eggs of the rosy aphis have hatched. The disadvantages of delaying the operation, the chief of which is the possible injury to foliage, are pointed out, but it is considered that on the whole the advantages outweigh the disadvantages. As the damage by these Aphids varies according to locality and seasonal conditions, it is suggested that each grower should test the efficacy of such treatment over a period of years on a part of his orchard, before making it a regular procedure.

Back (E. A.) & Pemberton (C. E.). **The Melon Fly in Hawaii.**—*U.S. Dept. Agric., Washington, D.C.,* Bull. no. 491, 30th June 1917, 64 pp. 24 plates, 10 figs. [Received 3rd August 1917.]

Dacus (*Bactrocera*) *cucurbitae,* Coq. (melon fly), is the most important pest of cucurbitaceous crops in the Hawaiian Islands, particularly as it attacks with the greatest persistency such crops as squashes, pumpkins and vegetable marrows, which would otherwise furnish an abundant food supply for the poorer classes. No part of

the plant is immune from attack, eggs being deposited on all portions of the plant and fruit. The larvae usually burrow to the centre of the plant or fruit, the place where they feed being largely dependent on the moisture content of the host. In young seedlings they may burrow into the root and kill the plant. It is estimated that this fly causes a loss of about 750,000 dollars in the Hawaiian Islands alone.

The present paper, which is an extension of an earlier one [see this *Review*, Ser. A, iii, p. 163], gives in a series of tables the results of further studies into the conditions of temperature and humidity as they affect the life-history of the fly. The complete life-cycle may occupy from 443 to 459 days in the case of average individuals passing the egg, larval, and pupal stages during the warmest seasons, but is more extended when these stages are passed during colder seasons. One individual has been known to lay as many as 1,000 eggs, and as there are 8 to 10 generations in a year, the fly multiplies very rapidly. In Hawaii, where the climate is warm and equable and there is abundant food supply, no agencies have been discovered that will check the abundance of the fly. Neither parasites nor predaceous enemies occur in the Islands, but it is hoped that future introductions of melon-fly parasites may prove beneficial. No artificial means of control have been successful, and these are not likely to be satisfactory in Hawaii while the growing of the chief host-plants remains in the hands of uneducated oriental labourers, who do not practice clean cultural methods or co-operate in applying remedial measures.

A bibliography of 51 works is appended.

Marsh (H. O.). **Life-History of *Plutella maculipennis* (Diamond-back Moth).**—*Jl. Agric. Research, Washington, D.C.*, x, no. 1, 2nd July 1917, pp. 1–10, 2 plates.

Plutella maculipennis, Curtis, is found infesting cabbage, cauliflower, rape and other cruciferous plants throughout the United States. In Colorado there are 7 generations in a year. Adults emerge from hibernation early in May and reproduction continues throughout the summer. Eggs are laid on the under-side of leaves, cabbage being the favourite host-plant, and the larvae burrow between the tissues of the leaves. Tables of rearing records are given; the life-cycle was found to occupy from 16 to 47 days. While potentially a serious pest, the diamond-back moth is normally held in repression by parasites, the chief of which is the Ichneumonid, *Angitia plutellae*, Vier. This parasite is occasionally infested by a Chalcidid hyperparasite, *Spilochalcis delira*, Cresson. Other parasites of *P. maculipennis* are *Meteorus* sp., *Mesochorus* sp. and a new species of *Microplitis*. When the parasites are not sufficiently numerous to hold the larvae of *P. maculipennis* in check, a spray consisting of 2 lb. Paris green and 6 lb. soap to 100 U.S. gals. water is an effective remedy.

Moore (W.) & Graham (S. A.). **A Neglected Factor in the Use of Nicotine Sulphate as a Spray.**—*Jl. Agric. Research, Washington, D.C.*, x, no. 1, 2nd July 1917, pp. 47–50.

Cases of poisoning having been traced to greenhouse lettuce sprayed with nicotine sulphate, experiments were undertaken to determine

why the chemical remained on the plants for as long as 12 days, while similar sprays containing free nicotine quickly disappeared. It was found that nicotine sulphate is non-volatile, and when hard water and soap are used in the spraying mixtures the alkalis contained in these substances set free the nicotine. The effects will vary according to the alkalinity of the water, the amount of alkali in the soap and the brand of commercial nicotine sulphate used, and this explains the different results obtained in the use of tobacco extracts and the reason why soap greatly increases the efficiency of sprays containing nicotine sulphate. As nicotine vapour is the principal cause of the death of insects in spraying with tobacco extracts, the maximum efficiency of those containing nicotine sulphate can best be obtained by rendering the spray alkaline before use. Commercial tobacco extracts containing nicotine sulphate should not be applied on greenhouse plants intended for use as food, though tobacco extracts or tobacco papers containing free nicotine may be employed with safety. Plants so sprayed, however, should not be cut for the market until the day after spraying. If the temperature of the house be low, a longer period should be allowed for the nicotine to evaporate from the leaves.

Baker (A. C.) & Davidson (W. M.). **A Further Contribution to the Study of *Eriosoma pyricola*, the Woolly Pear Aphis.**—*Jl. Agric. Research, Washington, D.C.*, x, no. 2, 9th July 1917, pp. 65–74, 2 plates, 1 fig.

In the present paper, which is a continuation of an earlier one [see this *Review*, Ser. A, iv, p. 369], the history of the various forms of this Aphid recorded on pear roots is discussed. A description is given of the stem-mother and the spring migrant of *Eriosoma pyricola* and these forms are particularly contrasted with those of *E. lanuginosum*. In the earlier paper it was mentioned that the autumn sexuparous migrants leave the pear roots upon which they have developed and fly to elm trees, where they deposit the sexual forms on the trunks and limbs. *Ulmus americana* and *U. campestris* are both used as hosts, but the latter is preferred. The female after pairing deposits a single egg in a crack in the bark or underneath a bud-scale. From this egg the stem-mother hatches in late March or April and ascends the trunk or limb to an expanding leaf. After it has fed for a few days on the under-surface, the leaf curls over, and by the time the insect is in the third instar the leaf has entirely closed round it, forming a gall. The stem-mothers feed 4 or 5 weeks in the immature stages and after maturity is reached the gall grows rapidly. The mature fundatrix deposits young prolifically, sometimes as many as 300 during the 4 or 5 weeks of her adult life. The young, wingless forms mature in about 3 weeks inside the gall, and apparently give rise to another generation, which later acquires wings. By the end of June nearly every gall examined contained winged forms; these begin to fly off at this time and practically all had disappeared by the end of July. Many larvae and pupae are destroyed by predatory insects, such as the Coccinellid, *Scymnus* sp., and Chrysopid larvae, which gain admittance to the interior of the galls after mid-June. Spring migrants were observed on pear foliage and deposit their young on pear trunks at or near the soil surface. Root-feeding generations were bred in the laboratory in

California from the wingless progeny of spring migrants and the third and fourth generations yielded a large percentage of autumn migrants. A diagram of the complete life-cycle of *E. pyricola* is given.

GATENBY (J. B.). **The Embryonic Development of** *Trichogramma evanescens*, **Westw,, a Monembryonic Egg Parasite of** *Donacia simplex*, **F.**—*Qtrly. Jl. Micros. Sci., London*, lxii, no. 2, February 1917, pp. 149–187, 3 plates. [Received 9th August 1917.]

This paper contains an account of the embryonic development of *Trichogramma evanescens*, which oviposits on the egg-mass of the Chrysomelid beetle, *Donacia simplex*, a single parasite emerging from one host-egg.

HUTSON (J. C.). **Some Soil Grubs in the West Indies.**—*Agric. News, Barbados*, xvi, no. 396, 30th June 1917, p. 202.

The root-borers included under this heading were mentioned in the previous issue [see this *Review*, Ser. A, v, p. 420]. The present paper deals with the other group of soil grubs, known as hard-backs. These include the Melolonthids, *Phytalus smithi* and an unidentified species of *Lachnosterna*, and the Dynastids, *Ligyrus tumulosus* and species of *Cyclocephala*, *Strategus* and other allied genera, some of which are scavengers in the larval stage. With the exception of *Ligyrus tumulosus*, these beetles are not attracted to lights, but must be sought in the fields at night. The two species causing most damage at present are *Phytalus smithi* (Barbados brown hard-back) and the Antigua brown hard-back, which is an unidentified species of *Lachnosterna*. Against the former, a vigorous campaign is being carried out, the adults being collected in thousands in the fields at night. An account of the latter has appeared in a previous paper [see this *Review*, Ser. A, v, p. 330].

CLUTTERBUCK (C. G.). **Notes on the Codling Moth** (*Carpocapsa pomonella*, **L.**).—*Proc. Cotteswold Nat. Field Club for 1915, Gloucester*, xix, part 1, December 1915. [Received 11th August 1917.]

The author records a case of larvae of *Cydia* (*Carpocapsa*) *pomonella* having been parasitised by the Tachinid fly, *Blepharidea vulgaris*. *B. vulgaris* is usually recorded as a parasite of *Abraxas grossulariata* (gooseberry moth) and has not, to the author's knowledge, been previously recorded as parasitising *C. pomonella*.

FARMER (J. B.). **Scientific Assistance. Its Importance on the Plantation.**—*Planters' Chronicle, Bangalore*, xii, no. 29, 7th July 1917, pp. 340–344.

The author, in an article in " The Rubber World and Financial Advertiser," reproduced in this paper, calls attention to the importance of scientific organisation and its application to the great plantation industries, and advises the establishment of a central institute, similar in general character to the Imperial Bureau of Entomology, for the study of plant pathology and for promoting scientific efficiency on plantations in the tropics. Both chemical and biological problems

present themselves which demand for their solution the highest skill of the best investigators, and unless the earliest symptoms of injury are constantly watched for and their causes traced by experts, it is only a question of time for disaster to occur. The extent and potential wealth of British tropical possessions undoubtedly justify better facilities for the full utilisation of the ever-growing resources of science, and whether these advances are going to be made by the British Empire or by some other competitor for the world's wealth, will be largely determined by the use or neglect of available knowledge.

Pour combattre les Vers gris de la Vigne. [To control the Caterpillars of *Feltia exclamationis* on Vines.]—*Vie Agric. et Rurale, Paris*, vii, no. 32, 11th August 1917, p. 102.

The Director of the "Services Agricoles" at Vaucluse, M. Zacharewicz, recommends the following methods of controlling caterpillars of *Feltia exclamationis.* They can be caught at night on the stocks, or trap holes may be made in the ground for them. Carbon bisulphide placed in holes a few centimetres deep around the trunks has been found successful. The liquids that have given the best results are: 1lb. potassium sulphide, 2 lb. black soap, 20 gals. water, which should be sprayed on the trunks at night; and 10 lb. black soap dissolved in 10 gals. boiling water, to which are added, while stirring, $\frac{1}{2}$ gal. paraffin and then $\frac{1}{2}$ gal. nicotine (100%) and lastly another 40 gals. water, which makes an equally good night spray. To prevent the caterpillars from ascending the trunks, a band of tanglefoot placed near the base is recommended.

Packard (W. E.). **Control of Grasshoppers in Imperial Valley.**—*California Univ. Agric. Coll., Berkeley,* Circ. no. 143, November 1915, 11 pp., 8 figs. [Received 14th August 1917.]

In this locality, *Melanoplus devastator* is the grasshopper most injurious to crops on account of its numbers. *Schistocerca vaga* is a common pest of trees, but has not been observed on plants of economic value. None of the species found are truly migratory, although they may pass from one field to another in search of food. The most effective control measure is cultural treatment. The usual remedies are recommended where the insects are numerous, and several types of hopper-dozer are described and illustrated. It has been observed that when sheep have pastured on land during the winter, very few grasshoppers appear in the spring. Apparently this is due to trampling of the ground.

Home-made Remedies against some Common Plant Pests.—*Planters' Chronicle, Bangalore,* xii, no. 29, 21st July 1917, pp. 366–368.

Leaflet no. 5, 1917, of the Department of Agriculture, Madras, which is reproduced in this paper, deals in a popular manner with the commonest pests of plants, including Aphids and scale-insects, and describes the method of preparation and application of the usual remedies.

MILLER (D.). **Pests and Diseases of New Zealand Flax.**—*Jl. Agric., Wellington, N.Z.*, xiv, no. 6, 20th June 1917, pp. 431–439, 2 figs.

The flax-grubs which damage the leaf and fibre of New Zealand flax (*Phormium tenax*) were the subject of investigation during 1916. The most prevalent and most injurious are: *Xanthorhoe praefectata*, Walk., the larvae of which attack the lower surface of the leaves, causing them to decay [see this *Review*, Ser. A, iii, p. 302]. If during a flood the water does not cover the flax-bushes or completely immerse the leaf-tubes, the larvae will still shelter in the unsubmerged portions or hang suspended among the foliage, and unless the head be submerged, seem indifferent to the water. If floated, however, they soon drown. Colonies of this species will migrate from place to place. The larvae first appear in early August and increase during the following months, disappearing at the end of December, when they hibernate in the leaf-tubes. Young and old may be found attacking the same patch of flax, indicating that they hatch at different periods. The species occurs throughout New Zealand.

Melanchra steropastis, Meyr., is found throughout the Dominion, but is most abundant in Southland. In general habits it resembles *Xanthorhoe*, but attacks the leaf differently, cutting notches in the edges. This species is found in both moist and dry localities practically throughout the year.

The larva of the Psychid, *Oeceticus omnivorus*, Fereday, is found throughout New Zealand and is active most of the year, but is not as yet of much economic importance.

The attacks of these grubs are of but slight importance in localities that are regularly flooded and where leaf-tube accumulations are not abundant, these two features being as a rule correlated. This has led to the use of artificial flooding as a control. Dead leaf-tubes should be regularly removed. Both these measures improve the quality of the flax quite apart from the question of grub attacks, which are said to be responsible for a loss amounting to £4 10*s.* per ton of fibre. A feasible method of applying moisture or of flooding would be by means of artesian wells, which have already been sunk in various parts of the swamps. The application of parasitic insects will be one of the most important methods of controlling the grubs. Ichneumonids are the most prevalent of these, about 67 species being recorded in New Zealand. *Xanthorhoe praefectata* has also been found parasitised by the fly *Syrphus ortas.* Insectivorous birds are an important check in the bush areas, but do not penetrate far into the swamps.

Several scale-insects infest flax-leaves, among them being *Poliaspis media*, which is sometimes present in great numbers.

DIAKONOVA [Mme E.). **Къ вопросу о распространеніи мускардины въ Донской области.** [On the Question of the Spread of Muscardine in the Province of Don.]—**« Вѣстникъ Садоводства, Плодоводства и Огородничества.»** [*Herald of Horticulture, Fruit-Growing and Market-Gardening*], *Petrograd*, lvii, no. 11–12, November-December 1916, pp. 369–386. [Received 31st August 1917.]

A general account of muscardine fungus in silkworms is given, with the results of some experiments carried out by the author in the

Province of Don, where this disease is prevalent. These confirm the view that infection may take place through the food as well as through contact with infested silkworm eggs; cockroaches and similar insects are also liable to this disease and may act as carriers of it amongst silkworms.

Prostosserdov (N. N.). **Культура и обработка чая въ Закавказьѣ.** [The Cultivation and Treatment of Tea in Transcaucasia]. Petrograd, 1917, 60 pp., 29 figs.

The tea-mite [*Tetranychus bioculatus*], scale-insects and the mole-cricket [*Gryllotalpa*], the latter especially injuring young plants, are here recorded as pests of tea in Transcaucasia.

Pliginsky (V.). **Растительные клещики, вредящіе садоводству.** [Plant-Mites injurious to Horticulture.]—**«Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, xvi, no. 1, January 1917, pp. 40–45, 9 figs. [Received 27th August 1917.]

The author is of opinion that the spread of Eriophyid mites, which he studied in the government of Kursk, where they are very common, is effected through the medium of seedling plants.

In the case of *Eriophyes pyri*, Pag., which is common on pear trees, this view is borne out by the fact that all the large nurseries throughout Russia are seriously infested with this mite, and it is thought that 90% of the trees in nurseries are thus attacked. This species is found practically all over the orchard-region in Russia. Though in this area wild pear trees suffer from this pest to the same extent as cultivated ones, the infection from these sources can only take place very slowly and then chiefly through the medium of wind or fallen leaves. The control of this mite should therefore be effected mainly in the nurseries, for which purpose fumigation with hydrocyanic acid is the best remedy; fumigation of all seedlings ought to be made compulsory.

E. ribis, Nal., is also very widespread, and though it is believed to be carried by wind, birds and insects, the chief agent of its distribution is provided by cuttings of currants used for propagation. Fumigation with hydrocyanic acid does not always destroy the eggs of this pest inside the bud, and further experiments should lead to the discovery of a more effective method for the application of this gas. Other remedies include the disinfection of seedlings by immersing them in water heated to about 115° F. ten minutes before planting; the removal and burning in spring of the infested buds; careful cleaning of the orchard in spring and autumn from fallen leaves, etc.; powdering the previously wetted plants with a mixture of 2 parts of flowers of sulphur with 1 part of lime, this being done in March and repeated again in April and May.

Leaves of plums all over Central Russia are infested with *E. padi*, Nal., and *E. similis*, Nal., both of which also live on blackthorn; their life-histories have not been fully worked out; the best known remedy is the removal and burning of fallen leaves in autumn. The same remedy can also be used against *E. tiliae*, Pag., occurring on lime trees and *E. macrochelus*, Nal., *E. macrorrhynchus*, Nal., and *Phyllocoptes gymnaspis*, Nal., on maples.

Ermakov (V.). **Вліяніе снѣжнаго покрова на растенія.** [The Influence of the Protection of Snow on Plants.] — **« Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, xvi, no. 2, February 1917, pp. 64–66. [Received 27th August 1917.]

The author refers to a previous article [see this *Review*, Ser. A, iv, p. 381] in which he expressed the view that the withering of many trees during the winter is due not to frost but to the action of insects. Many insects pass their early stages in the soil, and are able to survive in winters when there is plenty of snow; for this reason, after snowy winters the fruit trees usually give a bad yield; on the contrary, in the case of cold winters without snow the insects in the soil perish and the trees bear well the following season.

Abakumov (F.). **Обзоръ виноградниковъ Ростовскаго на Дону округа въ филлоксерномъ отношеніи.** [Review of the Vineyards of the Rostov-on-Don District with reference to *Phylloxera*.]— **« Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, xvi, no. 2, February 1917, pp. 68–76, 5 figs. [Received 27th August, 1917]

The province of Don is still free from *Phylloxera*, but as this pest is present in the neighbouring province of Kuban and some parts of Caucasia, attention is called to the caution necessary when importing vine plants from these districts, and a general account of the life-history and description of the insect is given, to enable vine-growers to identify it if it should be imported.

Zvierezomb-Zubkovsky (E.). **Практическій опредѣлитель главнѣйшихъ насѣкомыхъ встрѣчающихся въ зернѣ и зерновыхъ продуктахъ.** [Practical Key to the Identification of the principal Insects found in Grain and Grain-Products], *Voronezh*, 1916, 17 pp. [Received 31st August 1917.]

This key has been prepared for the use of students attending the courses for the training of instructors on the control of pests of grain and flour, which have been established by the Department of Agriculture at the Voronezh Agricultural High School, in charge of Prof. V. A. Pospielov. Some general directions are given for the examination of grain and flour, with a number of tables for the identification of the various pests. Some indications as to the presence of pests can be obtained, when inspecting the grain, from the presence of the adult insects or the moulted skins of their larvae. A little experience enables the presence of pests even in apparently undamaged grain to be detected; for instance, a grain containing the egg of *Calandra granaria* is covered with particles of flour and bears a minute shining spot; grains containing the larvae or adult of this weevil are usually of a dull colour and this also applies to grains infested with *Sitotroga cerealella*, Oliv. Where inspection of grain does not reveal any traces of pests, a sample is tested by immersing it in cold or preferably salt water, when the damaged grain will rise to the surface. The grain can further be tested by sifting it and examining the waste with a magnifying glass for the insects or their excreta. Flour containing *Tyroglyphus farinae* has a disagreeable smell; when a glass filled with it is exposed to light for 24 hours, the illumined side will

show zig-zag lines, due to the movements of the mites escaping from the light, and small conical heaps of such flour will in a short time change their form, owing to their constant movements.

The tables given include those for the identification of the Curculionid and Lepidopterous pests and their larvae and for identifying them in accordance with the peculiar form of damage or from their excreta.

WATERSTON (J.). **Notes on Coccid-infesting Chalcidoidea.—iii.**—*Bull. Entom. Research, London*, vii, no. 4, May 1917, pp. 311–325.

This paper, in continuation of a previous one [see this *Review*, Ser. A, v, p. 165], deals mainly with species bred on the West Coast of Africa. The following are described: *Coccidoxenus distinguendus*, sp. n., reared from *Lecanium* sp. on coffee in the Gold Coast; *Aëthognathus afer*, Silv., from *Stictococcus diversiseta*, Silv., in the Gold Coast; *A. afer*, var. *cavilabris*, n., from *Stictococcus dimorphus* in Uganda; *Eusemion cornigerum*, Walk., from *Parafairmairia gracilis* in Britain; *Habrolepis apicalis*, sp. n., from *Chionaspis minor* in the Gold Coast; *Aspidiotiphagus citrinus*, Craw, from *Chionaspis graminis* in Ceylon, from *Aspidiotus rapax* (*camelliae*) in Rhodesia and from *Chionaspis minor* in the Gold Coast; *Eriaporus laticeps*, sp. n., from a scale on cacao in the Gold Coast.

THEOBALD (F. V.). **The Aphid of Tea, Coffee and Cacao** (*Toxoptera coffeae*, **Nietner**).—*Bull. Entom. Research, London*, vii, no. 4, May 1917, pp. 337–342, 3 figs.

Toxoptera coffeae, Nietn., of which *Ceylonia theaecola*, Buckt., and *Toxoptera theobromae*, Schout., are treated as synonyms, is described from West Indian, Ceylon and African material taken on tea, coffee and cacao.

NEWSTEAD (R.). **Observations on Scale-Insects (Coccidae).-iii.**—*Bull. Entom. Research, London*, vii, no. 4, May 1917, pp. 343–380, 2 plates, 27 figs.

The following new species are described: *Platysaissetia carpenteri*, from Uganda on fig; *P. ferox*, from Southern Nigeria; *Akermes andersoni*, from British E. Africa, on orange leaves; *A. quinquepori*, from British Guiana, on *Microlobium acaciaefolium*; *Lecanium hirsutum*, from East Africa; *L. pseudotessellatum*, from Trinidad, on *Chrysobalanus pellocarpus*; *L. wardi*, from British Guiana, on leaves of Malacca apple, many individuals being infested with a fungus; *L. aequale*, from British Guiana, on *Avicennia nitida*; *L. acaciae*, from British E. Africa, on *Acacia melanoxylon* and *Albizzia moluccana*; *L. adersi*, from Zanzibar, on mango leaves; *L. cajani*, from Southern Nigeria, on pigeon-pea; *Saissetia* (*Lecanium*) *hurae*, from British Guiana, on *Hura crepitans*; *S.* (*L.*) *persimile*, from British E. Africa, on peach stems; *S.* (*L.*) *subhemisphaericum*, from Uganda and the Gold Coast, on coffee; *S.* (*L.*) *signatum*, from Uganda, on guava; *S.* (*L.*) *scutatum*, from British Guiana, on *Mimusops globusa*; the colonies of the female Coccids of this species were attended by a small black ant which had constructed a rough covering over them;

S. (*L.*) *subpatelliforme*, from the Gold Coast; *S.* (*L.*) *subhirsutum*, from the Gold Coast, on *Blighia sapida*, attended by small red ants, and on *Tabernaemontana*, *Landolphia*, *Oroxylon* and *Garcinia*; *L. setigerum*, from Uganda, on guava; *Eucalymnatus* (*L.*) *chelonioides*, from British Guiana, on *Pachira insignis* and *P. aquatica*; *Chrysomphalus* (*Aspidiotus*) *erythraspidis*, from British Guiana, on *Erythraspis glauca*; *Evaspidiotus* (*A.*) *fimbriatus*, Mask., var. *capensis*, n., from South Africa, on Cycads; *Aspidiotus* (? *Chrysomphalus*) *mauritianus*, from Mauritius, on palm trees; *Odonaspis* (*Aspidiotus*) *pimentae*, from Jamaica, on *Pimenta officinalis*; *Chionaspis distorta*, from South Africa; *C. capensis*, from South Africa, on *Acacia* sp.; *C. fici*, from British E. Africa, on wild fig.

DISTANT (W. L.). **On Some Rhynchota of Economic Importance from Colombia.**—*Bull. Entom. Research, London*, vii, no. 4, May 1917, pp. 381–382, 1 plate.

Trichocentrus ? *gibbosus*, Horv., and *Collaria oleosa*, Dist., are recorded as injurious to rice, and *Monalonion atratum*, Dist., *M. illustris*, sp. n., *M. megiston*, Kirk., and *M. collaris*, sp. n., were found damaging cacao pods.

FISKE (W. F.). **Insects Injurious to Vegetation.**—*Bull. Entom. Research, London*, vii, no. 4, May 1917, pp. 383–389.

The author criticises the general attitude of economic entomologists towards the question of insects being injurious to vegetation and deprecates their adherence to a doctrine which is admittedly antiquated. With a view to emphasising his argument, he discusses the work entitled "A Treatise on some of the Insects Injurious to Vegetation" written by Dr. Thaddeus William Harris in response to a request by the government of the State of Massachusetts in 1837 that he should survey and report upon the insect fauna of that State. In Dr. Harris's view, insects were created by supernatural agency in order to fulfil some essential part in the economy of nature and their relations, both to vegetation and to mankind, must be either definitely inimical or definitely beneficial. The author of the present paper expresses surprise that the outlook of the majority of economic entomologists to-day is almost identical with this view, expressed so many years ago. He argues that in the light of the theories of Lamarck and Darwin, insects, as well as man, are creatures of environment, imposing new conditions of life upon others as their evolution proceeds, and having new conditions of life imposed upon them by other organisms. The factors that operate in the natural control of species are largely identical with those which directed the evolution of these species into their present forms, and which continue to operate in a never-ending process. The constant reference by entomologists to the "natural enemies" of other species is opposed to the Darwinian hypothesis of good competing with good to prove which is the better, rather than good competing with evil for the mastery. A parasitic species cannot be the enemy of its host species without becoming its own enemy by the same act; if it destroys its host, it has destroyed its own chances of survival. The fittest parasite to survive must be the one which

not only refrains from injuring and weakening its host, but which in some manner serves to benefit it. One species of organism is injurious or beneficial in its relation to another species only in accordance with the circumstances and conditions prevailing at the time and place which brings them into contact. Thus, the parasitic micro-organisms which cause disease in man are generally considered to be obnoxious and the natural enemies of the human species in all circumstances, but so long as enmity characterises the relations between different races of mankind, the parasitic enemy of one race may easily be the friend of another race, if the two races differ in degree of immunity. In America, for example, where many European parasites were introduced with the early colonists, the native race, being less resistant than the partially immunised Europeans, fell ready victims to the diseases introduced by the parasites; this weakened their defence and they were easily conquered and practically exterminated by the combined forces of parasites and men. In Africa, on the other hand, conditions are reversed, and it is the native race which is immunised to parasites to which the European races are susceptible; until these parasites have been conquered Africa will remain in possession of the Africans.

In both these instances, and there are many more, the parasites are actually and actively friendly to the more immune race whenever it comes into competition with one more susceptible but otherwise stronger. It is this question of competition which was overlooked by Dr. Harris and has been overlooked by so many modern entomologists, although it is so strongly emphasised in the Darwinian hypothesis. The struggle, which Dr. Harris looked upon as a conflict between noxious insects causing injury and beneficial insects working for good, is now recognised as a no less active struggle between competitors than between predator and prey or between parasite and host, and when natural enmity of a parasite towards its competing hosts is unequally displayed, the parasite may well be the real enemy of the one and the real friend of the other.

This principle applies to the inter-relations between all plant and animal species and therefore to the relations between insects and their plant hosts on the one hand and their parasites and predatory enemies on the other. It explains also such obscure phenomena as the disappearance of the American cabbage butterfly throughout large areas following the introduction of a European competitor. Other examples were noticed in connection with attempts to introduce into America the parasites and "natural enemies" of gipsy and brown-tail moths. To quote an example among trees, the gipsy moth [*Lymantria dispar*] attacks both oak and pine, but the former more severely than the latter. Where the two trees are competitors for space, as in New England, the pine trees, though injured to some extent, have benefited through the oaks having been injured in a proportionately greater degree. Vegetation, in fact, has not been injured by the gipsy moth; certain plants and trees only have been injured to the benefit of their competitors. Phytophagous insects as a class cannot therefore be considered as generally injurious rather than beneficial to green plants as a class, or to vegetation. Such an assumption accords neither with fact nor with the theory of natural evolution and natural control of species. With a few exceptions, such as the migratory locust and other very indiscriminate feeders, insects

are as beneficial as they are injurious to vegetation whenever plants are competing among themselves for space in which to grow. Neither can any insects be classed as obnoxious to man, as it may easily be that a large number of human beings will be benefited by the misfortunes of a small number.

CORY (E. N.). **Fumigation of Greenhouses.**—*Maryland Agric. Expt. Sta., College Park,* Bull. no. 205, April 1917, pp. 264–282. [Received 7th August 1917.]

This paper gives detailed instructions for fumigating greenhouses. The results of experimental fumigation on various insects are shown in tables.

The second part of the paper discusses fumigation with special reference to humidity and temperature and gives the results of experiments in fumigation under various conditions of heat and moisture. Night was found to be the best time for the process. Definite doses may be recommended under optimum conditions of heat and moisture for different plants, and under normal conditions for various insects. Slight reductions in the doses may be effected by increasing the temperature to a maximum of 70° F. without injury to plants, if the humidity is kept at or below 50% saturation. High moisture is certainly liable to produce injury to plants, but both high moisture and high temperature will increase insect mortality if the dose is below the optimum for the insect concerned. When possible, plants other than stove plants should be fumigated at night with the optimum dose for the insect, with a temperature at or below 50° F. and with the atmosphere about half saturated.

CORY (E. N.) & O'NEILL (F. H.). **The Hothouse Milliped.**—*Maryland Agric. Expt. Sta., College Park,* Bull. no. 206, April 1917, 12 pp., 3 figs. [Received 7th August 1917.]

Reports of injury attributed to *Oxidus gracilis*, Koch (hothouse millipede) led to the investigations recorded in this bulletin. Though probably of tropical origin, *O. gracilis* has apparently been introduced into the United States from Europe. Under normal conditions it appears to have only one generation a year. The various stages are described. Manure and decaying vegetable matter form its principal food. Dead leaves lying on the soil are also eaten after they become moist, the midrib and larger veins being left. Experiments seem to show that millipedes will not burrow in sand after the raw ends of cuttings or newly formed roots and will not attack the stems of plants even under the stress of hunger, while they can subsist for some time on the humus in the soil. Germinating seeds are sometimes attacked. It is believed that millipedes can be starved into attacking the roots of some plants and under certain conditions may damage them to a limited extent. Some instances of predaceous habits are given, among the victims being a green Aphid. Circumstances point to a centipede as a possible natural enemy.

Bait-traps, made by placing slices of potato or carrot in a small depression covered with a flower-pot, are useful, or a hole may be cut in a potato and the tuber buried in the soil. Tobacco products are probably the best material for controlling *O. gracilis*. Tobacco dust

sprinkled at the rate of 300 lb. per acre—or 1 oz. per 9 square feet—proved fairly effective. On the day following such treatment about 85% of the millipedes on the beds were dead, though under the surface only about 5% were killed. Two days later none could be found on the surface and the number in the soil was about half of the number found in the control plots. On another plot, a second application was given three days after the first with the result that at the end of the week only about 5 per cent. of the former number remained. Nicotine solution 40% and nicotine sulphate 40% also give good results, if the soil is well drenched. If enough of the solution is put on the beds, a very few applications should rid the house of this pest.

PETTIT (R. H.). **Report of the Department of Entomology.**—*Fifty-fifth Ann. Rept. Michigan State Bd. Agric. for Year ending 30th June 1916, Lansing,* 30th June 1916, p. 186. [Received 29th August 1917.]

The inspection of apiaries has been carried on and a number of demonstrations in disease control have been held, but more inspectors are required to make the work efficient. Both American and European foulbrood are spreading over the State, and owners of apiaries are unable to cope with the disease, being unfamiliar with the symptoms and ignorant of the treatment. A change in the law providing for deputy inspectors is advocated.

PETTIT (R. H.). **Report of the Entomologist.**—*Twenty-ninth Ann. Rept. Expt. Sta. Michigan Agric. Coll. for Year ending 30th June 1916, Lansing,* 30th June 1916, pp. 281–282. [Received 29th August 1917.]

The most notable event of the year was the serious invasion of the bean-maggot [see this *Review*, Ser. A, iv, p. 527], and of the red cherry leaf beetle [*Galerucella cavicollis*]. The work of rearing parasites of the San José scale [*Aspidiotus perniciosus*] has progressed, several further species having been added to the list. The control work by means of parasites has distinctly improved the conditions in several localities, when employed in conjunction with spraying. An attempt to introduce the European parasite of the tamarack saw-fly was unsuccessful; a further attempt will be made with fresh material from Europe.

RUGGLES (A. G.). **Miscellaneous Notes on Economic Work; Orchard and Shade Tree Insects, Spraying, Truck and Field Crops.**—*Sixteenth Rept. Minnesota State Entomologist for 1915 and 1916, St. Anthony Park,* 1st December 1916, pp. 59–64. [Received 7th August 1917.]

Spraying experiments in Minnesota during the two years under review have demonstrated that arsenate of lead is a better spray for potatoes than Paris green. It is important to apply this before the eggs of the potato beetle hatch. If applied when the spring beetles are flying, it will stick to the leaves through the rains and the larvae will feed on the poison when they hatch. Two sprayings in the season are

found sufficient to keep the insect in check. For regular orchard spraying a dormant spray of lime-sulphur is found to be unnecessary, San José scale [*Aspidiotus perniciosus*] not being present in the State. Three sprayings of the orchard are found sufficient to keep insects and diseases under control: when the flower-buds begin to show colour, just after the blossoms fall, and two or three weeks later. The materials recommended are 3 lb. arsenate of lead paste or $1\frac{1}{2}$ lb. powder to $1\frac{1}{4}$ U.S. gals. lime-sulphur, at 32° Bé., in 50 U.S. gals. water. If Aphids are present, $\frac{1}{2}$ pint 40% nicotine-sulphate solution should be added.

Agrilus arcuatus (oak twig-girdler) has not previously been reported from the State. The damage becomes apparent in August, when the leaves on the twigs wither owing to the larvae tunnelling beneath the bark of the twig and cutting off the food-supply. In July of the second year they reach their full growth and pupate in the wood beneath the bark. By the end of July, the adults are emerging. The only known control is to prune all dead and dying limbs from the trees. Red oak [*Quercus rubra*] is the favourite host tree, but bur oak [*Q. macrocarpa*] and white oak [*Q. alba*] may also be attacked.

The clover seed chalcis [*Bruchophagus funebris*] damages something like 25 per cent. of the clover in the State; it breeds freely in red clover and in lucerne, but apparently not in white clover. The first crop should be cut for hay while the heads are green or pink, or clipped in May, the second crop being allowed to grow to seed. Self-sown clover should not be allowed to bloom.

The wheat stem maggot [*Meromyza americana*] damages a considerable amount of wheat, rye, barley, maize and bluegrass each year. The measures suggested are stacking the grain and threshing from the stack. This would prevent the escape of all the flies except those emerging from the outer layers of the stack. Trap crops, ploughing under the self-sown grain after harvest and keeping wild grasses in check by clean cultivation are also advisable. Autumn-sowing of wheat should be as late as possible; this is also a good preventive against Hessian fly [*Mayetiola destructor*].

The strawberry weevil [*Anthonomus signatus*] damages the blossoms and prevents the formation of fruit. As the weevils hibernate in the strawberry field under straw and leaves in the old bed, the one-crop system is recommended. If two crops are required, the field should be cleared of weeds after the fruit harvest and the bed burned.

The raspberry fruit worm hibernates in the soil at the base of the plants; in the spring the adults emerge and feed on the tender leaves and buds. Cultivation in late autumn and early spring close to the stems will disturb the hibernating pupae. Spraying the canes in spring when the plants are about 6 inches high with 2 lb. powdered arsenate of lead to 50 U.S. gals. water is very effective.

MARCOVITCH (S.). **The Strawberry Weevil in Minnesota** (*Anthonomus signatus*, **Say.**)—*Sixteenth Rept. Minnesota State Entomologist for 1915 and 1916, St. Anthony Park*, 1st December 1916, pp. 109–134, 4 plates. [Received 7th August 1917.]

This paper is a review of the bionomics and control of *Anthonomus signatus*, Say. Much of the information has previously been abstracted [see this *Review*, Ser. A, iv, p. 189, and the preceding paper].

The parasites reared from this weevil in Minnesota include the Chalcids, *Eupelmus coleopterophagus*, sp. n., *Catolaccus perdubius*, sp. n., *Habrocytus obscuripes*, Ash., *Polynema consobrinus*, Gir., *Eurytoma* sp., and the Cecidomyid, *Lestodiplosis* sp. During July from 30 to 43 per cent. of parasitism is recorded.

A complete bibliography covering the period 1897–1915 and including 42 works is given.

RUGGLES (A. G.). **The White-marked Tussock Moth.**—*Sixteenth Rept. Minnesota State Entomologist for 1915 and 1916, St. Anthony Park*, 1st December 1916, pp. 68–70, 1 fig. [Received 7th August 1917.]

The past season has been favourable for the development of the white-marked tussock moth [*Hemerocampa leucostigma*] in Minnesota, where basswoods, elms and maples are the principal trees attacked. The life-history and control of this moth have already been dealt with [see this *Review*, Ser. A, v, p. 174].

MARCOVITCH (S.). **Insects attacking Weeds in Minnesota.**—*Sixteenth Rept. Minnesota State Entomologist, 1915 and 1916, St. Anthony Park*, 1st December 1916, pp. 135–152, 4 plates. [Received 7th August 1917.]

The subject of weed-infesting insects is extremely complex, and it is sometimes difficult to tell where the usefulness of an insect begins and where it ends. Some insects feed entirely on one species of noxious weed, and are thus entirely beneficial. *Ceuthorrhynchus marginatus*, Payk., infests the seeds of the noxious dandelion (*Taraxacum officinale*), destroying about one-fourth of them. On the other hand, weeds are alternate host-plants of some of the worst crop pests and often foster serious insect outbreaks. The corn root aphis [*Aphis maidiradicis*] maintains itself on smartweed and foxtail until maize is planted, and the tarnished plant bug [*Lygus pratensis*] has a wide range of weed host-plants. The original habitat of native pests and the places where they are most frequently found are the forest edges and thickets, composed largely of rank weeds. With the destruction of forests, and the building of roads, farm wood-lots, etc., the thicket formation has greatly increased. The present paper only attempts to deal with the insects infesting herbaceous weeds.

Rumex crispus (curled dock) harbours *Pegomyia bicolor*, Wied. (curled dock leaf-miner), the larvae of which were found in June mining in the leaves. Pupation of one larva was observed on 15th June, the adult emerging on 8th July. *Gastroidea polygoni*, L. (knotweed leaf-beetle) oviposits in *Polygonum convolvulus* (wild buckwheat) at the beginning of August on the underside of the leaves, which the young larvae devour. *Chenopodium album* (lamb's quarters) is a host of *Pegomyia hyoscyami*, Panz. (spinach leaf-miner). There are three broods annually ; eggs are deposited under the leaves, the first larvae being observed in May and June. *Gnorimoschema artemisiella*, Kearf. (wormwood web-worm), is also found on this plant and on sunflower and *Artemisia*, and on golden-rod as a leaf-miner. Larvae have been observed in June, pupation follows in early July and emergence in mid-July. Insects on *Portulaca oleracea* (purslane) include

Aprosthena zabriskei, Webster and Mally (purslane sawfly), which deposits eggs in the edges of the leaves from June to September, there being apparently several generations. One larval parasite, *Ichneutidea secunda*, was reared from this species, and two egg-parasites, *Anaphoidea conotracheli*, Gir., and *Achrysocharis kansensis*, Gir., which emerged in July. *Bruchus cruentatus*, Horn (partridge-pea weevil) was found in the seed pods in autumn. *Petalostemum pupureum* (prairie clover) is infested by *Apion varicorne* (prairie clover weevil), which was observed in June and again in August; pupation took place on 17th August, adults emerging on the 24th. This species is also recorded on the flowers of huckleberry and the flower-heads of *Perosela aurea*.

Insects on *Astragalus canadensis* (milk vetch) include *Bruchus schrankiae*, Horn, which hibernates in the larval stage in the pods, the first adults appearing in early July. There are probably two broods. *Tychius aratus*, Say, (milk vetch weevil) appears not to have been recorded from any food-plant before. Oviposition in the pods occurred in early July, pupation in early September and by the end of the month adults were emerging. A Phycid moth was found in early July in the larval stage tying the leaves to the immature pods. One adult appeared on 15th July. *Phorbia* sp. is abundant on the pods at the end of August, the larvae being voracious feeders. These insects keep this noxious weed entirely in control.

Oenothera biennis (evening primrose) is one of the food-plants of the weevil, *Tyloderma foveolata*, Say, which has been recorded as seriously injuring strawberries in British Columbia. Oviposition occurs early in June, on the stem, where a scar is left. All stages may be found throughout the summer; pupae were found in late August in the stem, whence adults emerged in a few days. There is one generation in a year, hibernation being in the adult stage. *Mompha stellella*, Busck (evening primrose bud caterpillar), works into the buds in July and August, and pupates for three or four weeks, adults emerging early in September. *Phalonia oenotherana*, Riley (evening primrose leaf-worm) is found in the terminal leaves. An adult moth was reared on 24th July. *Asclepias syriaca* (milkweed) harbours *Rhyssomatus lineaticollis*, Say (milkweed weevil), which oviposits at the end of June, making long gashes in the stem; the larvae enter the soil to pupate at the end of August. *Plutella maculipennis*, Curt., was found pupating on the terminal leaves, one adult emerging on 7th August. This species is a minor pest of cabbage. *Anosia plexippus*, L. (milkweed butterfly) is found in the larval stage on the underside of the leaves during summer. *Physalis* (ground cherry) is a host of *Lema trilineata* (three-lined leaf-beetle), which is a pest of potatoes. The beetles oviposit under the leaves of the ground cherry during June. One larva was observed to pupate in early July, the adult emerging on 27th July. There are probably two broods. *Verbascum thapsus* (mullein) is frequently badly infested with *Gymnetron tetrum*, F. (mullein weevil), the larvae feeding in the seed pods. Insects on *Solidago canadensis* (golden-rod) include the Chrysomelid, *Trirhabda canadensis*, Kirby, the larvae of which are very abundant on the leaves in June. Pupation took place in the breeding cage in early July, just below the surface of the soil, adults emerging in nine days. *Agromyza posticata*, Mg. (golden-rod leaf-miner) blacken the leaf-tips; the larvae pupated late in June, adults emerging in about three weeks. *Silphium perfoliatum*,

L., harbours the Chrysomelid, *Microrhopala vittata*, F., which mines the leaves. *Heliopsis scabra* (rough ox-eye) is the host of *Agromyza virens*, L., which mines the bases of the plants in large numbers. These larvae have also been reared from the stem of the roadside thistle.

Helianthus hirsutus (wild sunflower) is one of the host-plants of *Physonota unipunctata*, Say (sunflower tortoise beetle), which also occurs on flowers of *Crataegus*, *Monarda* (horse mint) and *Silphium* (rosin weed). The beetles are found eating the leaves and ovipositing at the end of May, adults of the next generation emerging in early August; there is one brood in a year, hibernation occurring in the adult stage. Several eggs were found to be parasitised by a new Chalcidoid, *Aprostectus whitmani*, Gir. The Trypetid, *Straussia longipennis*, Wd. (sunflower stem-borer) lays its eggs in June in the stem, the larvae mining down the pith and in the roots; there is one generation in a year, winter being passed in the pupal stage in the stems. *Dichomeris* (*Trichotaphe*) *inserrata*, Wals. (sunflower leaf-roller), rolls the terminal leaves together and eats the edges.

Artemisia ludoviciana (white sage) is frequently infested by *Eucosma* (*Thiodia*) *artemisiana*, Wals. (wormwood leaf-tier), the terminal leaves being tied together by the larvae, which are active in late May and June. *Arctium lappa* (burdock) is commonly infested by the seed caterpillar, *Metzneria lappella*, L.

Cirsium discolor (roadside thistle) harbours *Agromyza virens*, Lw., the larvae mining in the stem; there is one generation only, hibernation being in the pupal stage. This species is also said to mine the roots of clover. *Platyptilia carduidactyla*, Riley (roadside thistle plume moth), attacks the terminal shoots; there are apparently two generations, adults emerging in early July and again in September. Larvae of *Muscina stabulans* were also found feeding on the terminal shoots. *Vanessa cardui*, L. (painted lady) feeds on thistles, rolling the edges of the leaves, and on many other host-plants, including mallow and pigweed.

Insects on *Cirsium arvense* (Canada thistle) include *Trypeta ruficauda*, F. (thistle seed maggot), and *Dasyneura gibsoni*, Felt (Canada thistle midge). These two species often destroy completely the seeds of this weed. *Lactuca scariola* (prickly lettuce) is infested by the larvae of *Phalonia bunteana*, Robinson, and *Phorbia* sp., which feed on the seeds.

BABCOCK (O. G.). **Minnesota Bill-Bugs.**—*Sixteenth Rept. Minnesota State Entomologist for 1915 and 1916, St. Anthony Park,* 1st December 1916, pp. 153–159. [Received 7th August 1917.]

Attacks from bill-bugs in Minnesota are confined almost exclusively to river valleys and lake-shore lands, and occur when maize, wheat, oats or timothy are planted near yellow nutgrass (*Cyperus esculentus*), which is the native food-plant. The principal species found is *Sphenophorus venatus*, which emerges in the spring and feeds upon exposed, unsprouted maize and partly buried, sprouted maize. The life-cycle apparently occupies about 58 days. Eggs are never deposited in the maize stalks, but always in sheaths of nutgrass. In the field, the larval period extends from late June to September, hibernation in all probability being in the larval or pupal stage. T[illegible]e is only one generation in a year.

S. zeae occurs at the same time as *S. venatus*, the food-plants and habits being similar. It is quite possible for these weevils to be carried considerable distances by water, their power of resistance to drowning being very great, and in this way infestation may be conveyed to fresh fields. *S. costipennis* and *S. ochreus* have also been recorded in Minnesota, while *S. parvulus* occurs in Illinois.

Methods of control are somewhat difficult. Autumn and spring ploughing is not practicable, as it would be almost impossible to destroy all the sedge, while the weevils are capable of emerging from a depth of 14 inches of earth. Maize should be planted at least 10 days after the adults emerge in spring, as the greatest damage is done before the mating season. It is noticed that a year of high water will produce many bill-bugs in the following spring; drainage would therefore be a help if not too expensive. It is not known what control may be exercised by parasites. Broken ears of maize soaked in arsenical poison and scattered over the field when the weevils first appear is suggested as a possible control.

Washburn (F. L.). **Further Observations on Minnesota Birds; their Economic Relations to the Agriculturist.**—*Sixteenth Rept. Minnesota State Entomologist for 1915 and 1916, St. Anthony Park*, 1st December 1916, pp. 160–183. [Received 7th August 1917.]

This further account of Minnesota birds deals with 24 insectivorous species of economic value [see also this *Review*, Ser. A, iii, p. 161]. Each species is well illustrated.

Milliken (F. B.). **Methods of Controlling Grasshoppers.**—*Kansas State Agric. Coll. Expt. Sta., Manhattan*, Bull. no. 215, November 1916, 30 pp., 19 figs. [Received 7th August 1917.]

This paper gives the usual controls against grasshoppers, together with notes on their life-history.

Chittenden (F. H.) & Howard (N. F.). **The Horse-Radish Flea-Beetle: Its Life-History and Distribution.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 535, 28th June 1917, 16 pp., 6 figs. [Received 7th August 1917.]

Phyllotreta armoraciae, Koch (*Haltica vittata*, Steph.) has been introduced into the U.S.A. from Europe. The larvae bore into the petioles or midrib of horse-radish and the adults feed on the leaves. Hibernation occurs in the adult stage, the beetles emerging in April and May. While only attacking horse-radish as yet, this beetle is a potential pest of more important cruciferous crops. No natural enemies have been observed. Bordeaux mixture, applied on the first appearance of the insect, will act as a repellent; arsenate of lead used later should be an efficient control. New beds should be far removed from old, infested ones; all self-sown plants should be destroyed.

Howard (L. O.). The Practical Use of the Insect Enemies of Injurious Insects.—Separate, no. 704, 1917, from *Yearbook Dept. Agric., Washington, D.C.*, 1916, 16 pp., 8 figs. [Received 7th August 1917.]

This paper reviews some of the most successful instances in which natural parasites have been introduced from their native country for the control of some imported pest. The Australian ladybird (*Novius cardinalis*), introduced into California to control *Icerya* (fluted scale), has been the most successful of these experiments, while the sugar-cane leaf-hopper (*Perkinsiella saccharicida*) has been largely controlled in Hawaii by *Paranagrus optabilis*, introduced from Australia, and the sugar-cane weevil-borer (*Rhabdocnemis obscurus*) by a fly [*Ceromasia sphenophori*] from British New Guinea. The author discusses the factors which contributed to the success of these introductions and points out that the problem of parasitisation is generally a complex and difficult one, as in the case of the introduction and establishment of *Schedius kuvanae* from Japan as a control of the gipsy moth [*Lymantria dispar*], and of the European parasite *Parexorista cheloniae* to control the brown-tail moth [*Euproctis chrysorrhoea*]. This work has on the whole been successful and, while it is almost certain that these two pests will spread further westward, the imported natural enemies will go with them, and it is unlikely that any such long-continued and disastrous outbreaks will occur as those experienced in Massachusetts some years ago. When the silk industry in Italy was threatened with extinction owing to the scale-insect [*Aulacaspis pentagona*] infesting the mulberry trees, the parasite *Prospaltella berlesei*, introduced from America and Japan, proved a most successful control.

Undoubtedly the future will see a considerable development of this biological method of controlling insect pests, and particularly in America, where more than one-half the principal crop pests have been accidentally imported from other countries, it seems likely that many successful introductions may be made of parasitic and predatory insects, and in fact of all species that are beneficial to agriculture. This would entail a great amount of biological study before the experiments were made, and the benefits could only be derived gradually.

Burgess (A. F.). Suppression of the Gipsy and Brown-tail Moths and its Value to States not infested.—Separate, no. 706, 1917, from *Yearbook Dept. Agric., Washington, D.C.*, 1916, 10 pp., 7 plates. [Received 7th August 1917.]

The history of the infestation of the gipsy moth (*Lymantria dispar*) and the brown-tail moth (*Euproctis chrysorrhoea*) in the United States is reviewed in this paper; the extent of the injury is described and illustrated by photographs and the methods of dispersion are discussed. The problem of introducing parasites for purposes of control has resulted in 7 or 8 species having become established which are helping to clear the States of infestation. The method of thinning out the favourite host-plants of these pests from the woodlands is dealt with [see this *Review*, Ser. A, v, p. 475], while every effort is

being made to prevent long-distance spreading of the insects. Several instances are given of the expenses incurred by various towns in carrying out control methods.

WORTHLEY (L. H.). **Solid-stream Spraying against the Gipsy Moth and the Brown-tail Moth in New England.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 480, 30th June 1917, 15 pp., 16 plates. [Received 7th August 1917.]

The most efficient and most modern methods of spraying for the control of gipsy moth (*Lymantria dispar*) and brown-tail moth (*Euproctis chrysorrhoea*) are described in this paper. Photographs and diagrams illustrate the descriptions of solid-stream spraying apparatus and operations, full directions being given for preparation of the mixtures and methods of application adapted to shade trees, woodlands and orchards. Much good work has already been accomplished in New England with this method of spraying, though a warning is given that other preventive measures must also be taken. If the infestation is severe, egg-clusters should be treated with creosote prior to spraying. From 800 to 1,000 tons of arsenate of lead and about 500 high-power solid-stream machines are being used each year in the New England States in this campaign, thousands of acres of park and orchard trees and woodland, as well as some 20,000 miles of street trees, being treated. When spraying is properly done to control gipsy moth, very little trouble is experienced with other leaf-eating insects.

Insects of the Season and Investigation Work.—*Forty-second Ann. Rept. Ontario Agric. Coll. & Exptl. Farm.—1916*, Toronto, 1917, pp. 10–14. [Received 9th August 1917.]

The various insect pests of agriculture noticed in 1916 in Ontario are briefly dealt with. Investigation work included tests with combination spraying mixtures. Detailed papers on these subjects have already been abstracted in this *Review*.

WILLCOCKS (F. C.). **A Note on the Rice Field Fly,** *Ephydra macellaria*, **Egger.**—*Bull. Soc. Entom. d'Egypte, Cairo*, no. 4, October-December 1916, pp. 102–105. [Received 20th August 1917.]

Though *Ephydra macellaria*, Egger, has been supposed to destroy considerable areas of rice in the northern part of Lower Egypt, the author believes it to be the result rather than the cause of the death of young rice. Up to the present the small, active larvae have been observed to feed only on dead and decaying vegetable matter, and perhaps on living matter in the form of algae. Healthy rice plants do not appear to be injured. It is suggested that the real causes of the dying-off of young rice may be chemical action, fungoid diseases, or other insects. Certain species of CHIRONOMIDAE are very abundant in the fields and a Dipterous stem-maggot also occurs.

WILLCOCKS (F. C.). **What Effect has Flooding of a Cotton Field by Infiltration from high Nile on the Numbers of the Pink Bollworm in that Field?**—*Bull. Soc. Entom. d'Egypte, Cairo,* no. 4, October–December 1916, pp. 105–108. [Received 20th August 1917.]

Records obtained from lamp-traps used as a possible means of controlling the pink boll-worm, *Pectinophora* (*Gelechia*) *gossypiella*, appear to show that heavy infiltration from a high Nile is decidedly unfavourable to this moth, as there was a sudden decrease in the number of captures subsequent to the field being flooded. Since *P. gossypiella* pupates to a very large extent on the ground amongst fallen leaves, etc., it would seem probable that heavy flooding lasting for weeks would be likely to cause the death of the pupae and probably also of pupating larvae. The larvae of *Earias insulana* pupate to a much greater extent on the plants and flooding would not affect them so much. This seems to be borne out by the lamp-trap figures.

GOUGH (L.). **On the Rate of Increase of *Gelechia gossypiella* Larvae in green Bolls during 1916.**—*Bull. Soc. Entom. d'Egypte, Cairo,* no. 4, October-December 1916, pp. 113–115, 1 diagram. [Received 20th August 1917.]

During the months July to November an investigation was carried out by the Entomological Section of the Ministry of Agriculture with the object of ascertaining the increase of severity of the attack of the larvae of *Pectinophora* (*Gelechia*) *gossypiella* in green cotton bolls. In all over 120,000 bolls were examined for larvae of *P. gossypiella* and *Earias insulana.* The results are shown in three curves on the diagram accompanying this paper. The first shows the average number of green bolls per 1,000 cotton plants for each week from 8th July to 27th October 1916. It rises fairly fast until the first week in August when 8,300 green bolls per 1,000 trees were found, the maximum of nearly 10,200 bolls being reached at a somewhat slower rate during the first week of September. From then it falls until the last date calculated, viz.:—the last week in September, when only about 5,200 green bolls per 1,000 trees were recorded.

The percentage curve for *P. gossypiella* remains fairly flat until the second week in August (5–9 per cent.), when it rises at a fairly uniform rate until the second week of October, at which time 86 per cent. infestation of green bolls is reached. After this it begins to fall irregularly.

As against this, the actual number of infested bolls per 1,000 trees increases slowly from about 270 in the second week of July to about 800 in the second week of August. After this it rises steadily until the third week of September when about 4,500 infested bolls per 1,000 trees is reached. From this time, the actual number falls.

Earias insulana was relatively unimportant during 1916. It appears to have sunk to the position of a minor pest not only relatively to *P. gossypiella,* but probably also absolutely.

Cock (S. A.). **An Orange Grove Pest.**—*Jl. Dept. Agric. Victoria, Melbourne*, xv, no. 6, 11th June 1917, p. 376, 1 fig. [Received 23rd August 1917.]

Since December 1916 *Tortrix ashworthana*, Newm. (*Cacoecia responsana*, Wlk.) (light brown apple moth) has become troublesome in the orange groves in Victoria. The eggs are laid on the rind of the fruit as well as on the leaves. The caterpillar attacks the rind of the orange, generally where there is a leaf in contact with the fruit or where two or more fruits touch each other. After gnawing along the rind the caterpillar bores into it and feeds, to a slight extent, on the pulp, in which it forms a cavity under the rind. In any case premature ripening ensues, with a consequent weakening of the stem, and the fruit falls in a semi-ripe condition. The caterpillar then enters the soil to pupate. The trees should be thoroughly sprayed with lead arsenate when the foliage is dry. The liquid must be forced into every part and the fruit-clusters must be well covered. All fallen fruit must be picked up daily and the soil around the trees should be frequently disturbed.

Treherne (R. C.). **The Strawberry Root Weevil in British Columbia.**—*Canadian Entomologist, London, Ont.*, xlix, no. 8, August 1917, pp. 257–260.

The strawberry root weevil, *Otiorrhynchus ovatus*, continues to be an important pest of strawberries in British Columbia [see this *Review*, Ser. A, iii, p. 7]. While primarily an insect adapted to the moist and cooler coastal areas, it has been reported as also causing considerable damage in the arid transitional areas of the interior. As it is unable to fly, its occurrence in many isolated islands and other spots far from cultivated land would indicate that it is an indigenous, and not an imported species. All evidence points to its being primarily a grass-infesting insect of more or less uniform distribution throughout the south of British Columbia. When native vegetation is removed, it will attack strawberry plantations, and though the strawberry is not the only fruit attacked, it suffers to a marked extent on account of its high state of cultivation in consolidated areas. It is therefore useless to purchase plants from non-infested districts. After briefly redescribing known measures of control, an account is given of experiments in burning over a strawberry field. The plants were dug up and roots, tops and straw bedding raked into windrows. After being left to dry for about 24 hours, while the weevils collected in them for shelter, they were burnt. At the time this work was done most of the adults had emerged from the pupae in the soil and were hidden among the débris around the plants. Egg-laying was in full swing and comparatively few larvae and pupae were left in the ground. The general result of the work showed that burning the plantation at the time when the greatest number of adults were on the surface is only partly successful, as the surviving adults would probably migrate to plantations near by and oviposit there.

TUCKER (E. S.). **Louisiana Records of the Bindweed Prominent (*Schizura ipomeae*, Ddy.).**—*Canadian Entomologist, London, Ont.*, xlix, no. 8, August 1917, pp. 280–281.

Specimens of a caterpillar collected on rose leaves in Baton Rouge, Louisiana, in October 1913 and September 1914 appear to be those of the bindweed prominent, *Schizura ipomeae*, Ddy., which also seems responsible for slight injury to pecan foliage. An arsenical spray would easily control this moth if necessary.

HOLLINGER (A. H.). **A new Species of *Phenacoccus* (Hemiptera, Homoptera).**—*Canadian Entomologist, London, Ont.*, xlix, no. 8, August 1917, pp. 281–284, 4 figs.

Phenacoccus pettiti, sp. n., here described and figured, is recorded from Missouri from a number of food-plants including :—*Ambrosia trifida*, *Rhus toxicodendron*, *Cercis canadensis* and *Fraxinus americana*.

GALIBERT (H.). **Conditions d'existence de l'*Obrium brunneum*, Fabr.** [The Life-history of *Obrium brunneum*, F.]—*Bull. Soc. Entom. France*, Paris, no. 11, 13th June 1917, pp. 183–184. [Received 7th August 1917.]

In 1890 Bedel reported the Longicorn beetle, *Obrium brunneum*, F., to be common on pines and firs, and the emergence of this species in the middle of May and its development in dead lower branches of *Abies picea* is now recorded in the department of the Tarn.

KEHRIG (H.). **Les Oiseaux et l'Agriculture. Sur la Régime alimentaire de quelques Oiseaux.** [Birds and Agriculture. The Diet of some Birds.]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xvi, no. 7, July 1917, pp. 65–69.

The author discusses the usefulness of certain birds which, far from being classed among insectivorous birds as beneficial to agriculture, have generally been regarded as noxious to the farmer, but which are found upon investigation to destroy a great many harmful insects. Examples of these are sparrows, larks and starlings, which not only destroy insects, but also eat the seeds of many noxious weeds. Blackbirds also destroy many insects and molluscs which infest fields and gardens. In the author's opinion the complaint that these birds eat beneficial insects is met by the answer that this is of small account if at the same time they rid the fields of the noxious species.

GODARD (A.). **Importance des Services rendus par les Oiseaux.** [The Importance of the Services rendered by Birds.]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xvi, no. 7, July 1917, pp. 73–76.

The economic value of many species of birds that destroy noxious insects is emphasised. The large sums spent every year on insecticides might be saved to a great extent by affording every protection to insectivorous birds.

Sur l'Attelabe curculionide. [Concerning *Attelabus curculionoides*, L.] —*Bull. Soc. Etude Vulg. Zool. Agric.*, *Bordeaux*, xvi, no. 7, July 1917, p. 77.

Attelabus nitens (*curculionoides*) is recorded from France on chestnut trees already infested with a fungous disease. The adults are found from May to July, pupation taking place in the ground. The eggs are frequently parasitised by the Chalcid, *Poropoea stollwercki*, Forst.

Capus (J.). **Sur un Dépérissement des Cultures de Pois en Gironde dû à la double Action de l'*Heterodera schachtii* et du *Fusarium vasinfectum*.** [Injury to Peas in Gironde due to the twofold Action of *Heterodera schachtii* and *Fusarium vasinfectum*.]—*Bull. Soc. Etude Vulg. Zool. Agric.*, *Bordeaux*, xvi, nos. 7–8, July-August 1917, pp. 70–73, 87–91.

Peas grown in Gironde have been injured since 1915 by a Nematode, *Heterodera schachtii*, and a fungus, *Fusarium vasinfectum*, continues the injury primarily due to infestation by the Nematode. On pulling up the withered plant the base of the stem, the root and rootlets are seen to be brown, and their bark does not adhere firmly. The spread of *H. schachtii* is due to the damp winters preceding the years 1915 and 1916, for this species can only live in a moist soil. The restriction of extensive Nematode infestation to peas may be due to the fact that they are sown in autumn in Gironde and thus present conditions favourable for the continuation of *H. schachtii* from one year to another.

Savastano (L.). **Irrorazione intensificata della poltiglia solfo-calcica contro il crisonfalo.** [Intensified Spraying with Lime-Sulphur against *Chrysomphalus dictyospermi*, Morg.]—*R. Staz. Speriment. Agrum. Fruttic*, *Acireale*, Bull. no. 30, May 1917, 4 pp. [Received 15th August 1917.]

The simplification of spraying is needed owing to the increased cost of materials and labour. Lime-sulphur may be used in stronger solutions, when a quicker action is required, the strength of the solution being only limited by the resistance of the trees, which is greater in winter [see this *Review*, Ser. A, v, p. 45]. As, however, the fruit is easily scorched, strong solutions should not be applied to oranges unless it is imperative to save the trees, but only to lemons, as this fruit, when scorched, is available for making lemon-juice. Spraying during September and early October should be done with a 10% mixture of a density of 1·25, and this strength should not be exceeded. The application must be uniform, but not abundant, or damage may result. If the fruit is of little value and infestation is considerable, a strength of 12% may be used, but never more. Strong solutions cause much defoliation, but as the leaves involved are the badly infested ones that would fall in any case, there is no real loss. These particulars are for using the Savastano formula for lime-sulphur [see this *Review*, Ser. A, ii, p. 412].

Moreira (C.). **O Bicho do Cacáo.** [The Cacao Worm.]—*Chacaras e Quintaes, Rio de Janeiro,* xvi, no. 1, 15th July 1917, pp. 10–11, 1 fig.

The caterpillars of the Pyralid, *Myelois duplipunctella*, Rag., infest cacao in Brazil, causing the pods to wither at various stages of their development. The eggs are deposited on the pods, into which the newly hatched larvae bore, penetrating into the endocarp and attacking the seeds. Pupation takes place in a white silk cocoon within the pod and lasts from 12 to 16 days. This moth occurs at least during the four months from June to October, the above observations being made during that period in 1910. The removal and burning of all the infested pods in a plantation is the remedy advised.

Contra o Bicho amarello das Raizes. [Against the Yellow Root Worm.] —*Chacaras e Quintaes, Rio de Janeiro,* xvi, no. 1, 15th July 1917, p. 27, 1 fig.

This popular note deals with the control of Elaterid larvae, which are unidentified, but resemble those of *Agriotes lineatus* (*segetis*), which is, however, smaller than this Brazilian species.

Lima (A. da Costa). **Informaçoes praticas resumidas sobre a Lagarta que ataca os Capulhos do Algodoeiro, especialmente destinadas aos pequenos Cultivadores de Nordeste.** [Brief practical Information on the Caterpillar attacking Cotton Bolls specially intended for small Growers of north-eastern Brazil.]—*Chacaras e Quintaes, Rio de Janeiro,* xvi, no. 1, 15th July 1917, p. 17, 1 fig.

This paper gives a popular account of *Pectinophora* (*Gelechia*) *gossypiella* (pink boll-worm), a recent introduction in Brazil.

Pierce (W. D.). **The Mexican Cotton Boll Weevil.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vi, no. 7, July 1917, pp. 291–295, 4 figs.

The author urges the necessity of extreme watchfulness against the introduction of *Anthonomus grandis*, Boh. (Mexican cotton boll weevil) on cotton seed into the Imperial Valley. An account of the habits and injury caused by the weevil is given. It is suggested that, as exposed ground at a temperature of 123° F. is fatal to the larvae, the rows should be planted in such a direction as to give the longest period of sun-heat to the ground between. The most efficient external parasites of the weevil are *Microbracon mellitor*, Say, *Catolaccus incertus*, Ashm., *C. hunteri*, Crawf., *Eurytoma tylodermatis*, Ashm., *Cerambycobius cyaniceps*, Ashm., *Microdontomerus anthonomi*, Crawf., and *Triaspis curculionis*, Fitch. *Euloewia globosa*, Towns., is an effective internal parasite of the larvae in moist districts, but is useless in dry regions. Ants of the genera, *Solenopsis*, *Pheidole* and *Monomorium*, as well as many birds, are predaceous enemies. Cultural methods of control are described. Quarantine measures have largely restricted the spread of the pest, and it is suggested that those at present in force should be rendered more comprehensive and more stringent, and that the shipment of wild cotton from anywhere should be forbidden.

Smith (H. S.). **The Alfalfa Weevil.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vi, no. 7, July 1917, pp. 295–297, 3 figs.

Lucerne is California's most valuable forage crop, and it is therefore essential to protect it against *Hypera variabilis* (*Phytonomus posticus*), which is the most destructive pest of lucerne in the United States. A strict quarantine is therefore maintained. The distribution of the weevil in the States is given, with a description of the life-history and habits and the methods of control which have been advocated in other States.

Berger (E. W.). **Whiteflies of Citrus.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vi, no. 7, July 1917, pp. 298–307, 9 figs.

This paper gives a brief account of the species of whiteflies known in Florida and the measures adopted against them. The most effective control has been found to be by means of fungus parasites, the preparation of pure fungus cultures for spraying purposes being described. Directions for spraying with oil emulsions and soap solutions are given. A comprehensive list of the whiteflies infesting citrus in different parts of the world is given, of which nine species are present in the United States, four having been introduced and five being native. This list contains no new species other than those previously recorded [see this *Review,* Ser. A, iv, p. 387].

Maskew (F.). **The Melon Fly** (*Dacus cucurbitae,* **Coq.**).—*Mthly. Bull. Cal. State Commiss. Hortic. Sacramento,* vi, no. 7, July 1917, pp. 307–309, 3 figs.

Dacus cucurbitae, Coq., has not as yet been recorded in California, though it is constantly being intercepted by quarantine officers at the port of entry. Under a State quarantine order no food-plants of the melon fly may be imported into California from Hawaii, and any such plants brought in are immediately destroyed.

Hoyt (A. S.). **The Mexican Orange Maggot** (*Trypeta ludens*).—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vi, no. 7, Jully 1917, pp, 309–311, 1 fig.

Trypeta ludens is said to be such a serious pest of oranges in Mexico that in some localities orange-growing has been abandoned, while the mango crop in infested districts is reduced to about one-fifth of its normal dimensions. Other fruits attacked are grapefruit, sweet limes, peaches, plums, *Achras sapota* and guavas. The complete life-cycle of the fly occupies about three months, thus permitting of four broods annually. Eggs are deposited within the fruit, whence the full-grown maggot emerges and pupates in the ground. In 30 to 46 days the adults emerge. The control of this fruit-fly in Mexico is a serious problem. The best results have been obtained so far with a sweet poison spray to destroy the adults, while all fallen fruit should be collected regularly and buried or burnt to destroy the larvae. This, however, during the season, would be an almost endless task. Quarantine measures in California have been successful in protecting the State from importations of the insect.

Smith (H. S.). **The Gipsy Moth and the Browntail Moth.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vi, no. 7, July 1917, pp. 311–316, 4 figs.

The history of *Lymantria dispar* and *Euproctis chrysorrhoea* in North America is described, with the usual control measures and notes on the life-histories and habits. While these pests are frequently taken on shipments of nursery stock to California, they have never been allowed to penetrate into the State.

Hecke (G. H.). **The Mediterranean Fruit-Fly.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vi. no. 7, July 1917, pp. 316–318, 3 figs.

This paper gives brief notes on the life-history and habits of *Ceratitis capitata* (Mediterranean fruit-fly), against which there are stringent quarantine regulations in California.

Maskew (F.). **Quarantine Division. Report for the Month of April 1917.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vi, no. 7, July 1917, pp. 321–322.

The following pests were intercepted : -From China : weevil larvae in sweet potatoes. From Japan : *Aleurodes* sp. on gardenia ; *Chionaspis wisteriae*, on wistaria ; *Pseudococcus* sp. on azaleas ; *Gymnosporangium japonicum* on *Juniperus procumbens* ; weevil larvae in sweet potatoes. From Connecticut : *Pseudococcus* sp. and *Aphis* sp. on greenhouse plants. From Costa Rica : *Pseudococcus* sp. on orchids. From Hawaiian Islands : *Diaspis bromeliae* and *Pseudococcus bromeliae* on pineapples ; *Coccus longulus* on betel leaves ; *Pseudococcus* sp. on green coconuts ; Trypetid larvae in coffee berries. From Manila : *Pseudococcus* sp. on rubber plants ; larvae of borers in orchids. From Massachusetts : *Diaspis boisduvali*, on orchids. From New South Wales : *Calandra* sp. in maize. From Pennsylvania : *Chrysomphalus aonidum* on *Ficus* sp. ; *Saissetia oleae* on ornamental plants. From Tahiti : *Morganella maskelli* on oranges ; mites and Lepidopterous larvae in Tahitian chestnuts. From Venezuela : *Diaspis boisduvali* and *Isosoma orchidearum*, on orchids. From Florida : *Lepidosaphes beckii* and *Phomopsis citri* on grapefruit. From Mexico : *Heliothis* (*Chloridea*) *obsoleta* on tomatoes. From Ohio : *Aleurodes* sp. on hibiscus and on jasmine. From Washington : *Fusarium* and *Rhizoctonia* on potatoes. From New York : *Aspidiotus* sp., *Pseudococcus* sp. and *Aleurodes* sp. on jasmine. From Panama : larvae of *Musca* sp. in potatoes.

Froggatt (W. W.). **Insects and Prickly Pear.**—*Agric. Gaz. N.S.W., Sydney*, xxviii, no. 6, June 1917, pp. 417–426, 4 figs. [Received 23rd August 1917.]

The chief insect living on the prickly pear (*Opuntia* sp.) is the cochineal insect, *Dactylopius coccus* (*Coccus cacti*), for the sake of which the plant was cultivated in Europe from the time when the Spaniards found the Incas cultivating it in Mexico in 1578 until the introduction of aniline dyes. Many attempts were made to introduce

the cochineal insect into different parts of the world, and the many varieties now known as "wild cochineal insects" are probably the variations produced by climatic conditions. *Diaspis echinocacti*, Bch. (*calyptroides*, Costa) (grey round cactus scale), has a very wide range and is common in Australia. *Nysius vinitor* (Rutherglen bug) is one of the few native insects attacking prickly pear. During the time of the great drought, when the mustard weed on which the bug breeds had dried up, the insects migrated to the prickly pear and infested it so heavily that it seemed as though the problem of the destruction of this giant weed was going to be solved; however, with the coming of the rains, the insects returned to the native herbage and the cactus recovered. Another insect found on prickly pear is *Oxycarenus lectularis* (coon bug), which is abundant in New South Wales. It has been suggested that the plant bugs, *Chelinidea vittigera* and *Narnia pallidicornis*, might be imported from the United States to control the cactus. Several insects recorded from the United States on cacti are mentioned, and a suggestion is made of experimenting with a large land snail which is said to show marked preference for cacti.

Thrips attacking French Bean Flowers.—*Agric. Gaz. N.S.W., Sydney*, xxviii, no. 6, June 1917, p. 426. [Received 23rd August 1917.]

In April 1917, the flowers of French beans were found at Wamberal, where they are an important crop, to be badly infested with thrips, which, coming from dandelions, swarmed on the bean flowers and fed on the pollen, causing the flowers to fall without pods being formed. In the next crop of beans spraying the flowers with tobacco and soap solution was tried with success. Clean cultivation was advised and particularly the turning under of all grass and weeds in which thrips might shelter before the bean flowers opened.

Clement (G. E.). **Control of the Gipsy Moth by Forest Management. Part I: The Gipsy Moth in Woods.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 484, 9th April 1917, pp. 1–16. [Received 7th August 1917.]

The author divides trees into four classes according to Mosher's classification [see this *Review*, Ser. A, iii, p. 668], having regard to their susceptibility to gipsy moth attack, and gives the following recommendations in forest management. Trees of low commercial value should be cut when interfering with the growth of more valuable ones of more resistant species. All trees that have begun to die should be cut, so as to prevent borer attacks. Valuable trees should not be cut merely from fear of insect attack, nor should they be removed, if not interfering with the growth of still more valuable species, unless they can be replaced by something better. Hardwood growth should be confined to the best soils; conifers, particularly white pine, should be encouraged on soils not adapted to hardwood. Woodlands should be so completely stocked with trees that undergrowth providing food for the gipsy moth will be too overshadowed to grow. Public forests should be given every encouragement.

MUNRO (W.). **Control of the Gipsy Moth by Forest Management, Part II: Management of Typical Woodlots Infested with the Gipsy Moth in the White-pine Region.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 484, 9th April 1917, pp. 17–49. [Received 7th August 1917.]

The conclusions reached in this paper are the results of food-plant experiments co-ordinated with known principles of forest management and with economic conditions in the infested region. Each woodlot or combination of species is found to present its own problem, in which the controlling factors are site, soil, location, market, value and proportion of the species present, degree of infestation and cost of labour. While many experiments are still in progress, it is evident that the possible field of forest management as a method of controlling gipsy moth is strictly limited, and even in the case of mixed hardwoods, where some measure of success may reasonably be expected, the cost is often prohibitive. In other forest types, control by forest management may or may not be an economic possibility. In many stands of the mixed-hardwood type in the white-pine region, spraying and creosoting must be done, while birds, parasites and insects must be relied upon to do their part in control. In cases of severe infestation, forest management may be less expensive than spraying and creosoting, and has the advantage of being constructive instead of merely palliative, but it cannot be recommended as a general method of control for indiscriminate application by States, cities, towns and private owners of woodlands throughout the infested region.

PATCH (E. M.). **Elm Leaf Rosette and Woolly Aphid of the Apple, *Schizoneura lanigera* (*americana* in part.)**—*Maine Agric. Expt. Sta., Orono*, Bull. no. 256, November 1916, pp. 329–344, 10 figs. [Received 7th August 1917.]

This bulletin is a revised edition of an earlier one [see this *Review*, Ser. A, i, p. 24]. *Eriosoma* (*Schizoneura*) *lanigerum* is one of the migratory Aphids and passes part of its life-cycle on apple trees and part on the elm. On the apple it occurs as a bark-feeder and is found upon branches, roots and tender places on the trunk, covered with the characteristic white, woolly mass. In August, winged females begin to appear among the wingless ones; these are the autumn migrants, which fly to the elm and there give rise to the generation of true sexes, the female of which deposits a single egg in a crevice of the elm bark. The stem-mother, hatching from this egg, appears about the middle of May on the partly opened leaf-buds. By the end of May, the stem-mothers are mature and producing the next generation. These nymphs, which are wingless, become fully developed about 10th June. Their progeny are winged and are the spring migrants. For about three weeks from 20th June, migration to apple, mountain ash and hawthorn is taking place. There are apparently three summer generations of progeny of the elm-leaf migrants upon the apple in Maine, two apterous generations being followed by a generation part of which, the autumn migrants, become winged and fly to the elm, while part develop into apterous forms remaining on the apple and give birth to nymphs which hibernate at the base of

the tree. It is the function of the migrants to seek the winter host and there give birth to the true sexes. Both sexes are wingless, and with the deposition of single eggs by the females the life-cycle is complete. The hibernating nymphs, which remain protected about the crown of the apple during winter and ascend the bark in spring, apparently form a closed cycle of apterous viviparous females persisting on the apple. How long such a colony could maintain itself on apple alone is not known. A parallel is found in *Pemphigus tessellatus*, the life-cycle of which includes a spring migration from maple leaf to alder and a return migration to maple in the autumn, as well as a generation of hibernating nymphs remaining at the base of the alder and ascending the stem before feeding in the spring.

The woolly aphis in Maine would probably be exterminated by natural enemies if it did not change its food-plant, Chalcid parasites, Syrphid larvae and Coccinellid beetles being active enemies. On the elm the Aphid is preyed upon by Syrphid larvae, Capsid bugs and Coccinellids. The study of this Aphid is further complicated by the root colonies that remain underground all the year round, apparently until the roots become too badly damaged for feeding purposes.

The remedies advocated in this bulletin have been dealt with in the earlier abstract referred to above.

Separate keys are given based on the life-cycle, structure, and habitat.

LOVETT (A. L.) & ROBINSON (R. H.). **Toxic Values and Killing Efficiency of the Arsenates.**—*Jl. Agric. Research, Washington, D.C.*, x, no. 4, July 1917, pp. 199–207.

A preliminary study of the relative toxicity of the arsenates of lead has previously been reviewed [see this *Review*, Ser. A, iii, p. 759]. The present paper records the continuation and enlargement of that work. Lead hydrogen arsenate is found to have a higher toxicity at a given dilution than either calcium or basic lead arsenate, and requires a longer period of time to kill nearly mature caterpillars than the smaller ones. The arsenic devoured by insects feeding upon sprayed foliage is not all assimilated, a portion passing through the intestinal tract into the excrement. The percentage of arsenic assimilated depends upon the form of arsenate used; lead hydrogen arsenate was assimilated readily in these experiments and most of the arsenic was retained in the tissue, while much of the basic lead arsenate was found in the excrement. It requires approximately 0·1595 mgm. of arsenic pentoxide to kill 1,000 small tent caterpillars [*Malacosoma*] and approximately 1·84 mgm. of arsenic pentoxide to kill the same number of nearly mature tent caterpillars, irrespective of the particular arsenate used as a spray. Preliminary experiments on the scorching effects of calcium arsenate indicate too severe injury to warrant the practical use of this spray.

VEITCH (R.). **The Hornet in Fiji.** (*Polistes hebraeus*, **F.**).—*Colonial Sugar Refining Co., Agric Rept. no. 2, Sydney*, April 1917, 16 pp., 1 plate. [Received 23rd August 1917.]

Polistes hebraeus, F., has become one of the commonest insects in Fiji. Its painful sting has given rise to an attitude of unqualified

condemnation of its habits, but a close study of its life-history shows that this is not justified. Fertilised females hibernate during August and September, and commence nest-building at the beginning of October. Several days after oviposition the larvae hatch and after being fed on sugary substances for a few days, receive a diet of insects. It is during this larval period, lasting 14 to 18 days, that the hornet proves its economic value, reducing considerably the number of insects injuring the cane crops, and playing an important part in the control of cutworms and army-worms, grasshoppers, crickets and flies. After a pupal period of about 15 days the adults emerge and the nests increase in size until the end of April. Mating occurs during June and July; by the end of July all the males are dead and the females begin to hibernate. In certain localities where the cane is thrashed during the season when the hornets' nests are at their maximum size, a good deal of trouble and expense is incurred in sending labourers encased in thick canvas to destroy the nests before thrashing the cane. Hornets' nests are frequently attacked and destroyed by enemies, probably lizards, spiders and ants, which feed on the larvae.

METCALF (Z. P.). **Biological Investigation of** *Sphenophorus callosus*, **Oliv.**—*North Carolina Agric. Expt. Sta., W. Raleigh,* Tech. Bull. no. 13, January 1917, 123 pp. 68 figs. 1 plate. [Received 23rd August 1917.]

This bulletin is an amplification of one that has been previously abstracted [see this *Review*, Ser. A, v, p. 445].

WILLIAMSON (W.). **Fall Treatment for Insect Pests of Field Crops.**—*Minnesota Insect Life, St. Paul,* iv, no. 5, 1st August 1917, p. 3.

Autumn ploughing and harrowing are advocated for the control of grasshoppers, wireworms, white grubs, cutworms, Hessian fly and many lesser pests, and the method suited to each is described. The burning of weeds and rubbish after harvest is recommended against Hessian fly [*Mayetiola destructor*], chinch bugs [*Blissus leucoptera*], wheat straw and joint worms [*Meromyza americana* and *Isosoma tritici*], army-worms and stalk-borers. Clover pests can be controlled by keeping down self-sown clover and by lightly pasturing clover in the autumn.

Change Wheat Storage Methods.—*Wkly. Press. Bull. Penns. Dept. Agric., Harrisburg,* ii, no. 32, 9th August 1917.

The Pennsylvania Department of Agriculture is urging farmers to avoid storing their wheat after harvest in warm, well-built barns, which offer ideal conditions for the rapid development of the Angoumois grain moth [*Sitotroga cerealella*], and is advising them to have their wheat threshed as soon after the harvest as possible. Wheat that is known to be infested before threshing should be fumigated with carbon bisulphide.

SNELL (J.). **An Invasion of the Caterpillars of the Antler Moth into Yorkshire.**—*Jl. Bd. Agric., London,* xxiv, no. 5, August 1917, pp. 523–526, 1 fig.

The damage caused by the antler moth [*Charaeas graminis*, L.] in Yorkshire in June, 1917, was very similar to the infestation in

Derbyshire. The grasses which were found to serve as food-plants were *Aira caespitosa* (tussock grass), *Nardus stricta* (mat-grass), the young shoots of both species having been devoured early, so that only the brown and dead blades of last year's growth were visible. Other plants attacked were *Anthoxanthum odoratum* (sweet vernal), *Festuca ovina* (sheep's fescue), *Agrostis alba* (fiorin), *Juncus squarrosus* (heath rush), *Luzula* sp. (wood rush) and *Carex* sp. In the author's opinion, in pastures surrounded by walls a trench or sprayed belt would be necessary only where there were gateways or breaks in the walls. Experiments were made with coal-tar waste products, some of the heavy, medium and light oils being tried and also an arsenical waste product obtained in the manufacture of sulphate of ammonia. All these substances acted as contact insecticides. Wash oil, when mixed with a large proportion of water to form an emulsion, acted as a powerful insecticide and seemed an effective barrier for a spray-belt. A fortnight after spraying the attack had not spread beyond the belt, and while no definite deductions can be made from this preliminary experiment, it seems possible that such belts would limit infestations.

HUTSON (J. C.). **Insect Notes.**—*Agric. News Barbados*, xvi, no. 388, 10th March 1917, p. 74.

In the abstract of this paper which appeared in this *Review*, Ser. A, v, p. 257, the sweet potato weevil (*Cylas formicarius*) was erroneously recorded as a pest of sweet potatoes in Barbados, though in dealing with its distribution, it was correctly stated to be unknown from the Lesser Antilles.

LEGISLATION.

Precautions against Fire-Blight.—*Jl. Agric., Wellington, N.Z.*, xiv, no. 5, 21st May 1917, p. 416.

As a further precaution against the introduction of pear-blight, or fire-blight of the pear (*Bacillus amylovorus*), into New Zealand, an Order in Council, dated 16th April 1917, has been issued, prohibiting the importation of pear, apple or quince trees or of cuttings, buds, or any other portion of any such trees, except the fruit, from any country or place in North America or Japan. From any other country or place shipment is prohibited unless the consignment is accompanied by a certificate to the effect that fire-blight of the pear does not exist in the country of origin. The Order also makes incidental amendments to the existing regulations.

Regulations under the Destructive Insect and Pest Act.—*Canada Gazette, Ottawa*, 28th July 1917.

By an Order in Council on the 17th July 1917 the Regulations of 1914 under the above Act were repealed and amended regulations were

passed in their place. The ports of entry for nursery stock entering Canada are named, with the dates during which such importations may be received. All such stock is required to be fumigated at the point of entry before it can be taken out of bond. Every package of nursery stock imported is to bear a declaration of the nature of its contents. All consignments are to be notified to the Dominion Entomologist. A list of products is given the importation of which into Canada is prohibited. The importation of nursery stock by mail is prohibited. Forest plant products from the New England States will be admitted only when accompanied by a certificate from the United States Department of Agriculture declaring them free from gipsy moth [*Lymantria dispar*]. Any importations condemned by the inspector will be destroyed. Inspectors have the right to enter any nursery or premises for purposes of inspection and to demand certain treatment or the destruction of any infested stock. It is declared illegal to offer for sale or dispose in any way of infested stock. Any infestation when discovered must be notified to the Minister of Agriculture.

The destructive insects included under this Act are: *Aspidiotus perniciosus* (San José scale), *Euproctis chrysorrhoea* (brown-tail moth) *Eriosoma lanigerum* (woolly aphis), *Aulacaspis pentagona* (West Indian peach scale), *Lymantria* (*Porthetria*) *dispar* (gipsy moth), *Ceratitis capitata* (Mediterranean fruit-fly), *Phthorimaea operculella* (potato tuber moth), *Hyponomenta malinellus* and *H. padellus* (apple and cherry ermine moths) and *Rhyacionia* (*Evetria*) *buoliana* (European pine-shoot moth).

Nursery Agents to be Licensed.—*Wkly. Press Bull. Penns. Dept. Agric., Harrisburg*, ii, no. 30, 26th July 1917.

In order to eliminate undesirable nursery stock from Pennsylvania, a nursery inspection law has been passed requiring all persons soliciting for the sale of nursery stock in the State to carry an official license. Noncompliance with this regulation incurs certain penalties under the Act.

A new insecticide and fungicide law provides for the inspection of spray materials, in which certain standards of purity are required.

A Proclamation under "The Insect Pest and Quarantine Ordinance, no. 5 of 1901."—*Ceylon Govt. Gazette, Colombo*, no. 6,888, 20th July 1917.

This proclamation declares the fluted scale, *Icerya purchasi*, to be an insect pest within the meaning of the Ordinance. For the prevention of its spread, regulations have been drawn up under the provisions of the Ordinance, requiring the owner or person in charge of any land on which an infestation of *I. purchasi* occurs to report the outbreak to the Director of Agriculture. Such land will then be declared an infested area and no plant shall be removed from it until it has been declared by the Director of Agriculture as free from infestation. Any land may at any time be inspected by a person authorised by the Director of Agriculture to determine whether *I. purchasi* be present or not. A list is given of estates that are declared to be infested areas.

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Cole (A. C.) & Imms (A. D.). **Report on an Infestation of Larvae of the Antler Moth** (*Charaeas graminis*, **L.**) **in the Peak District.**—*Jl. Bd. Agric., London,* xxiv, no. 5, August 1917, pp. 514–522.

Caterpillars of the Noctuid, *Charaeas graminis*, L. (antler moth) were found in June, 1917, infesting the hill pastures in the High Peak District of Derbyshire. Previous outbreaks have been recorded at some years' interval, chiefly in the northern counties and Scotland, while in Ireland the insect is universally common. During the month of August, female moths may frequently be seen dropping the eggs from their bodies whilst flying, and these fall among the grasses which serve as food-plants for the larvae. Opinions are conflicting as to whether hibernation occurs in the egg or young larval stage, but the caterpillars are generally noticeable about the end of May; they feed voraciously for about three weeks and then pupate beneath the soil or under slabs of stone, the adults beginning to emerge in July and flying until September. Information with regard to the food-plants of this moth is scanty. In the present infestation the rough grasses were chiefly attacked, though in certain districts better meadow land and even an occasional corn crop was infested, while some of the caterpillars penetrated into gardens. *Nardus stricta* (bent grass), which forms much of the upland pastures at heights of 750 feet and over, seemed to be the favourite food, while *Eriophorum* (cotton grass) and other species suffered less severely. The infestation was noticeably heavier as the altitude increased; in fact, the presence of bent grass and the altitude appeared to be distinct factors in the limitation of the infestation; the attacks were apparently confined to an altitude ranging from 900 ft. to 1,700 ft. The finer and more succulent grasses in many cases were left for coarser hill pastures adjacent. The caterpillars exhibited no definite migratory instinct, though they were observed to move with surprising rapidity, generally travelling downhill; in some cases they seemed to be searching for fresh areas of grass; in others, they moved through an abundance of suitable grass without stopping to feed.

Two efficient barriers were found to be water and stone walls; the streams and roadside channels contained vast numbers of drowned individuals, while the caterpillars seemed unable to climb the vertical faces of the stones forming the loosely-built walls that are a feature of the district.

All the natural conditions of the past season have been advantageous to the pest. Plovers and starlings have both been exceptionally scarce, while the unusually severe weather has in all probability caused a certain reduction of bird life in general. The late snow on the hills formed a protection to the young caterpillars, while the ground in the spring was so frozen that the reduced flocks of birds could not gain access to them. The burning of the coarser mountain pasture growth has almost been abandoned during the past two years owing to the prohibition of the exposure of lights, and there is little doubt that in past years the custom of burning has been an important factor in destroying the eggs or caterpillars in March and April. The long spell of dry weather which followed the emergence of the larvae undoubtedly encouraged development, while the lack of moisture at the same time emphasised the injury to the grasses.

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For the future control of the pest it is suggested that it might be advantageous to cut permanent trenches transversely across each upland pasture in a similar manner to the Canadian trenches for catching the army worm [*Cirphis unipuncta*]. If both sides of the trench were trimmed so as to be quite vertical, the caterpillars might be trapped from two directions. After a severe winter such as that of 1916–17, due warning might be sent to the farmers of any expected infestation and trenches could then be cut directly the frost disappeared. Poison sprays proved ineffectual, as the bent grass will not retain any considerable quantities of the spray. Poisoned bran mash such as is scattered broadcast in Canada is hardly feasible in the case of the antler moth, but a mixture of 20 lb. bran and 1 lb. Paris green stirred into $3\frac{1}{2}$ gals. water containing 3 finely chopped oranges or lemons and 2 quarts of molasses might be scattered over a belt about 10 yards wide between an infested area and a crop it is desired to protect. It is hoped that the order regarding exposed lights may be somewhat modified in future by the authorities during the burning season. Greater discrimination should be shown in the preservation of bird life: rooks and starlings are a great help in control, while the scarcity of the lapwing encouraged the infestation in the year under discussion.

WORSHAM (E. L.). **Nineteenth Annual Report of the State Entomologist for 1916.**—*Georgia State Bd. Entom., Atlanta*, Bull. no. 48, 1917, 36 pp. [Received 28th August 1917.]

The control of the cotton boll weevil [*Anthonomus grandis*] in Georgia is an entirely different problem from that faced by other States which have made a thorough study of it, because soil and climatic conditions are different. During 1916 the increase of the pest was rapid, although a systematic fight has been made in all counties where it occurred. A study of the possible insect transmission of cotton diseases led to the conclusion that while insects probably play but a small part in the dissemination of cotton anthracnose in a field, they may play a large part in carrying the disease from one field to another and from one plant to another when these are not in contact.

The work of controlling the usual pests of peaches and apples has been continued and elaborated. Other insect pests included the cotton or melon aphis [*Aphis gossypii*] and the cabbage aphis [*Aphis brassicae*], which were controlled by a dilute solution of Blackleaf 40. *Nezara viridula* (green soldier bug) became a serious pest owing to the lack of parasites due to the unfavourable season. Only strong contact poisons, such as 10 per cent. kerosene emulsion, give any degree of success. Clean cultivation and the destruction of rubbish in and about the fields in winter is advocated. The barnacle scale, while not a serious pest, is numerous on greenhouse and ornamental plants. If parasites do not sufficiently control it, a weak kerosene emulsion should be sprayed on the plants just after the young have attached themselves. *Aspidiotus obscura* (gloomy scale) injures many shade trees; a spray composed of one part scalecide to 7 or 8 parts water is recommended.

Insects attacking stored products include the granary weevil [*Calandra granaria*], rice weevil [*C. oryzae*], saw-tooth grain beetle [*Silvanus surinamensis*] and red or square-necked grain beetle

[*Carthartus gemellatus*], as well as Angoumois grain moth [*Sitotroga cerealella*]. The usual process of fumigation by carbon bisulphide is recommended.

Pecan insects include *Acrobasis nebulella* (pecan case-bearer), which is causing more injury than any other species. The total parasitism of 247 individuals was 2·3 per cent., the Hymenopterous parasites including *Exochus apicalis*, Cres., and *Macrocentrus* sp. The spray recommended consists of 1 lb. dry arsenate of lead, 2 lb. lime, 2 lb. fish-oil soap to 50 U.S. gals. water, which should be applied thoroughly to the under-surface of the leaves only, from about the middle of August to mid-September. *Acrobasis hebecella* (nut case-bearer) may become a very serious pest of pecan. There are probably three generations; parasitism seems to amount to about 50 per cent. in the first generation. *Enarmonia caryana* (shuck worm) is the most wide-spread pecan pest, but is only occasionally numerous enough to be injurious. Hymenopterous parasites include *Calliephialtes grapholithae*, Cress., *Phanerotoma tibialis*, Hald., and *Microbracon* sp.

Aphids include *Monellia costalis* and an apparently new species of this genus. *Hyphantria cunea* (fall web-worm) severely infested nut groves; careful work during the earlier part of the season would have given almost complete control of this pest by destroying the insects with torches, while they are assembled in the webs, or by spraying with arsenate of lead.

Velu (H.). **Deuxième Campagne d'Experimentation de la Méthode d'Hérelle au Maroc contre** *Schistocerca peregrina*, **Oliv. (Mars–Juillet 1916).** [Second Experimental Campaign with d'Hérelle's Method in Morocco against *Schistocerca peregrina*, Oliv. (March–July 1916.)].—*Ann. Inst. Pasteur, Paris*, xxxi, no. 6, June 1917, pp. 277–290. [Received 13th August 1917.]

In recording the investigations made in 1916 with *Coccobacillus acridiorum* for the control of *Schistocerca peregrina* in Morocco, certain practical results which might be expected from this mode of destruction were discussed [see this *Review*, Ser. A, v, p. 99]. The present paper records some useful observations which were made during the course of the investigations. The invading hordes of locusts may be infected by an epizootic of contagious enteritis caused by a *Coccobacillus* of the same group as the bacillus of d'Hérelle; the gravity of these epizootics is variable, but they prevent the increase of the virulence of d'Hérelle's *Coccobacillus* which has been preserved *in vitro*. It is thought that this coccobacillary enteritis of locusts is probably of more common occurrence in nature than has been suspected, and may account for the disappearance of the swarms for years at a time. As contamination is almost entirely the result of cannibalism, the epizootics produced by artificial means are proportionately more effectual as the hordes of locusts become denser and cannibalism reaches its maximum. The most favourable time for spraying is the end of the third instar. When used liberally, the biological method should considerably diminish the importance of locust and cricket attacks, facilitating the mechanical methods of control and reducing expense at the same time.

Speare (A. T.). *Sorosporella uvella* **and its Occurrence in Cutworms in America.**—*Jl. Agric. Research, Washington, D.C.*, viii, no. 6, 5th February 1917, pp. 189–194, 1 plate.

The presence of the fungus, *Sorosporella uvella*, in two larvae and a pupa of the cutworm, *Euxoa tessellata*, Harr., that had died in breeding jars, is recorded. It was visible only on breaking open the body, when it appeared as a reddish brown, powdery mass. This seems to be the first published account of its occurrence in America, its last appearance in Europe having been in 1888. Several more infected insects were subsequently received and cultural tests were attempted, without however yielding entirely satisfactory results.

Frohawk (F. W.). **Destruction of Wheat by Wasps.**—*Entomologist, London*, l, no. 649, June 1917, pp. 132–133, 1 fig.

The common wasp, *Vespa vulgaris*, is recorded as damaging growing wheat in the autumn of 1916, over an area 300 yds. long by 5 or 6 yds. wide. The whole injury was caused by the individuals of a single nest, and consisted in gnawing the ears, probably to obtain nesting material, so that in some cases the lower half of the ear was removed, leaving the bare stem.

Girault (A. A.). **Notes on some Parasites of Sugar-cane Insects in Java, with Descriptions of New Hymenoptera Chalcidoidea.**—*Entomologist, London*, l, no. 649, June 1917, pp. 134–136.

This paper contains descriptions of *Gonatocerus bifasciativentris*, sp. n., from the eggs of a leaf-hopper embedded in the leaves of sugar-cane; *Trichogramma minutum*, Riley, reared from the eggs of *Chilo infuscatellum*, Sn.; *Parachrysocharis javensis*, sp. n., reared from leaf-hopper eggs, probably those of *Flata affinis* on the leaves of sugar-cane, each egg containing one parasite; and *Cyrtogaster javensis*, sp. n., reared from the eggs of an unknown moth on the leaves of sugar-cane.

Bordas (M. L.). **Du Rôle de quelques Ichneumonides comme Auxiliaires de l'Aboriculture forestière.** [On the Part played by Ichneumonids in combating Forest-tree Pests.]—*C. R. hebdom. Acad. Sci., Paris*, clxiv, no. 24, 11th June 1917, pp. 923–925.

Two of the most useful Ichneumonids controlling the insect pests of pine, oak and spruce forests are *Rhyssa persuasoria*, L., which attacks the larvae of *Sirex*, and *Ephialtes manifestator*, which parasitises certain Buprestid and Cerambycid larvae, especially those of *Callidium*.

Jablonowski (J.). *Pseudococcus nipae* (*Dactylopius nipae*), **a Scale Insect injurious to Palms in Hungary.**— *Internat. Rev. Science and Practice Agric., Mthly. Bull. Agric. Intell. and Pl. Dis., Rome*, viii, no. 6, June 1917, p. 958. [Abstract from *Zeitschrift für Pflanzenkrankheiten, Stuttgart*, xxvii, no. 1, 15th February 1917, pp. 1–18.] [Received 1st September 1917.]

Pseudococcus nipae, Mask., is recorded from a palm in a greenhouse in Hungary in February 1916. It has probably been imported into

Hungary from Belgium and is now very common in glasshouses in Budapest, being found on *Phoenix*, *Kentia*, *Latania* and *Areca*, to which it causes considerable damage. The author gives a detailed account of the characters, geographical distribution and economic importance of this scale-insect and recommends the notification of infested greenhouses, with a view to checking its spread.

BERLESE (A.). *Scutellista gigantea*, **Berl., sp. n.**—*Redia, Florence*, xii, no. 1–2, 25th April 1917, pp. 179–180.

This is a description of a new Chalcid, *Scutellista gigantea*, bred from *Ceroplastes mimosae* in Eritrea.

NIELSEN (J. C.). **Undersøgelser over entoparasitiske Muscidelarver hos Arthropoder. VI.** [Researches on endoparasitic Muscid Larvae in Arthropods.]—*Videnskabelige Meddelelser, Odense*, lxviii, 1917, pp. 23–36, 20 figs.

In the English summary of this paper, *Panzeria minor*, Villen. & Niels., is recorded as parasitising the caterpillars of *Taeniocampa pulverulenta*, Esp., and *Calymnia trapezina*, L. The larva previously recorded as that of *Ernestia connivens*, Zett., is now stated to belong to another species, probably *Plagia trepida*, Meig. *Winthemia quadripustulata*, F., has been bred from *Vanessa io*, L., *V. urticae*, L., *Cucullia lychnitidis*, Ramb., and *Trigonophora* (*Brotolomia*) *meticulosa*, L. *Frivaldzkia distincta*, Meig., was bred from the caterpillars of *Drepana falcataria*, L., *Ematurga atomaria*, L., *Cabara pusaria*, L., *C. exanthemata*, Sc., *Cidaria corylata*, Thb., *Eupithecia* (*Tephroclystia*) *indigata*, Hb., and from young caterpillars of *Sphinx pinastri*, L. *Campylochaeta obscura*, Fall., is parasitic in the caterpillars of *Crocallis elinguaria*, L. *Tachina rustica*, Fall., has been bred in June from the larvae of an undetermined saw-fly feeding in September on clover. *Goniocera enigmatica*, Villen. & Niels., was bred from caterpillars of *Malacosoma castrensis*.

TOPI (M.). **Nuove Esperienze di Lotta contro le Tignuole dell' Uva.** [New Control Experiments against the Vine Moths.]—*Minerva Agraria, Milan*, ix, no. 13–14, 15th–31st July 1917, p. 167. [Abstract from *Atti R. Accad. Lincei, Rome*, xxvi, series 5, 1st half-year, no. 4, 18th February 1917.]

Previous experiments [see this *Review*, Ser. A, ii, p. 679] in the control of vine moths [*Clysia ambiguella* and *Polychrosis botrana*] were continued in 1916. In the preceding year about one thousand stocks were wrapped in rags, etc., and in January 1916 these shelter-traps were removed, the top joints of the canes supporting the vines being cut off at the same time. In the small portion of this material which was examined very few pupae were found. These vines were sprayed on 15th May and 30th May. On the first occasion an aqueous solution of 0·8 per cent. lead arsenate was applied, and on the second, Bordeaux mixture with 1 per cent. lead arsenate. To increase the adhesiveness of the latter spray, 0·1 per cent. of casein was added. After they had been slightly defoliated the same vines were sprayed on 19th July

with a solution of 2 per cent. tobacco extract and 0·2 per cent. soft potash soap, and this spray was applied again on 31st July. Care was taken to operate under conditions obtaining in normal practice. At the end of August there was a reduction in the number of larvae varying from 71 to 85 per cent., corresponding to a reduction in the number of damaged grape berries varying from 52 to 84 per cent. An experiment was made with a single treatment on 31st July with copper-sulphur containing 5 per cent. of powdered lead arsenate. This showed a reduction of 40 per cent. in the number of the larvae and 21 per cent. in that of damaged berries, but the advisability of such arsenical treatment in mid-summer is questionable. While the results of the combined winter-spring-summer treatment are not negligible, they are uncertain and do not therefore solve the problem of vine moth control entirely.

Rastello (F.). **Il Grillotalpa.** [The Mole-Cricket.]—*Riv. Agric., Parma*, xxiii, no. 35, 31st August 1917, pp. 464–465.

This is a popular article on the mole-cricket [*Gryllotalpa gryllotalpa*] and its destruction by the usual methods. In Crete gardeners collect plants of *Euphorbia cyparissias*, crush them and express the juice, which is mixed with water in a 2–4% solution. After an hour's time this liquid is used for watering the ground in which the seeds of melons, cucumbers, etc., are to be planted. If planting has been done early and germination has already taken place, the watering is done round the stem only over a radius of 4–8 inches.

Un nuovo Rimedio contro la Filossera? [A new Remedy against *Phylloxera*.]—*Riv. Vitic. Enol. Agrar., Conegliano*, xxiii, no. 17, 1st September 1917, pp. 290–291.

This article is an abstract of a report by Berlese and Del Guercio to the Italian Ministry of Agriculture on a remedy against *Phylloxera* discovered by Signor Guido Manetti. The apparatus consists of a glass tube, which is joined by rubber tubing to a short lead tube. The glass, which is filled with a certain liquid, is fastened vertically to the stock and the lead tube is screwed into a perforation made in the stock about 12 or 16 inches from the ground. The apparatus, which lasts for years and may be used on several stocks in the course of a year, costs about 2*d.* and the liquid also is cheap. On the 22nd August 1916, ten strongly infested European stocks were thus equipped and the same liquid was used for two further stocks fitted with an arrangement designed by Berlese some years ago. At the end of a month the foliage and grapes of seven of the vines were withered while those of the others resembled those of the control vines. This injury was ascribed to an excess of liquid (about 3½ oz. per stock) or to an incorrect proportion of the three component ingredients. The woody parts were not affected. Examination of the roots showed that the surrounding soil was impregnated with special effluvia and that the roots were almost free from the insects; the few remaining specimens were discoloured and died in the laboratory. The infestation on the roots of the untreated vines was very severe. The experiments could not be pursued further for the time being.

CECCONI (G.). **Manuale di Entomologia Forestale.** [Manual of Forest Entomology.]—*Florence*, Fasc. 6, 64 pp., 108 figs.

The sixth part of this book [see this *Review*, Ser. A, v, p. 358] covering pp. 321–384 continues the account of the Coleopterous pests of forests.

CARPENTER (G. H.). **Injurious Insects and other Animals observed in Ireland during the Years 1914 and 1915.**—*Econ. Proc. R. Dublin Soc.*, ii, no. 12, September 1916, pp. 221–233, 8 figs., 4 pl. [Received 10th September 1917.]

The summer of 1914 was noteworthy for the great abundance and wide-spread occurrence of the diamond-back moth, *Plutella maculipennis*, Curtis (*cruciferarum*, Zell.), which caused extensive damage to the leaves of Cruciferous crops, especially white turnips and swedes. Caterpillars of the turnip moth, *Euxoa* (*Agrotis*) *segetum*, L., were very destructive to cabbage and turnip in King's Co. and Queen's Co. in late July and early August, eating the plants just below the surface of the ground. The cabbage fly, *Chortophila* (*Phorbia*) *brassicae*, Bch., was, as usual, abundant, and the maggots were even found feeding on radishes in a garden in Co. Dublin. The oat aphis, *Aphis avenae*, F., of which the migratory apple aphis, *A. fitchi*, is a synonym, swarmed on oats in Co. Kerry in July 1915. This species is harmful, both in the orchard and on grain crops; the winged males and wingless females are found in late autumn on apple trees, where the latter lay their eggs, from which arise the stem-mothers of the following spring. After a few generations of parthenogenetic females, winged insects appear, which migrate to grasses, including cereals. Some of the Aphids on oats proved to be *Macrosiphum granarium*, Buckt. The potato aphis, *Rhopalosiphum solani*, Theo., was found in March 1914 feeding on the developing shoots of potato tubers from Co. Antrim, owing apparently to the autumn females having oviposited on the tubers. This aphis has been confused with *R. dianthi*, which is a species with many food-plants. The sexual forms are as yet unknown, but the parthenogenetic females, even the winged forms, are able to live underground, so that oviposition probably occurs on the tubers. The larvae of a species of *Bibio* feeding in potato tubers was reported from Co. Tyrone in March 1914. Damage to potatoes by caterpillars of the rosy rustic moth, *Hydroecia micacea*, Esp., was reported from Co. Louth in July 1915. This caterpillar, like that of the frosted orange moth, *Gortyna flavago* (*ochracea*), both feeds and shelters in the hollowed-out stalk, its usual host-plants being the dock (*Rumex*) and horsetail (*Equisetum*). When fully grown, it pupates in the soil, close to the roots of its food-plant, and the moth emerges in August and September, laying eggs that carry the species over the winter. These caterpillars cause great injury owing to their habit of going from one plant to another, and nothing can be done to destroy them short of pulling up and burning the infested plants. The larvae of the black carrion beetle, *Silpha opaca*, L., were reported from Westmeath in June 1915 as damaging the leaves of young mangel plants. The brassy flea-beetle, *Chaetocnema* (*Plectroscelis*) *concinna*, Marsh., was reported as abundant on young mangel plants. This small species attacks Cruciferous crops, being included under the general term

"turnip-fly," and it is very destructive to hops in the south of England, where it is known as the "hop-flea." It is difficult to destroy these insects on a large scale, but arsenical sprays might give good results. The green leaf-beetle, *Phaedon tumidulus*, Germ., is a common insect in Ireland on cow-parsnip (*Heracleum sphondylium*), and in November 1914 it was found eating holes in the leaves of celery plants in Co. Dublin. The carrot fly, *Psila rosae*, F., was found in carrots from Co. Clare in August 1914, and in celery plants from Co. Sligo in December 1915, boring upwards into the stems. *Piophila apii*, Westw., recorded in 1848 as mining in celery stems, is probably a synonym of this species. The flax flea-beetle, *Longitarsus parvulus*, Payk., was particularly abundant and destructive in Ulster in June 1915. The caterpillars of the turnip moth, *Euxoa* (*Agrotis*) *segetum*, Schiff., had been recorded four years previously as harmful to tobacco plants, and similar reports were received in October 1914 from King's Co. and elsewhere, the damage being greatest on light, gravelly soils. Specimens of the heart-and-dart moth, *Feltia* (*Agrotis*) *exclamationis*, L., were at the same time found on tobacco leaves, also in King's Co. The common shield-bug, *Tropicoris rufipes*, was reported in July 1915 from Kilkenny as injuring young apples by puncturing the skin and sucking the sap. In June 1915 another common bug, *Palomena prasina*, injured apple foliage in Co. Galway. A Capsid bug, *Lygus pabulinus*, has already been recorded as harmful to rose leaves, and a shield-bug, *Acanthosoma haemorrhoidale*, to apple-buds in Ireland [see this *Review*, Ser. A, ii, p. 8]. Though active throughout life, the young stages of these insects seem to do more damage than the adults. The most effective remedy seems to be a soap and nicotine mixture. The plum aphis, *Aphis pruni*, Réaum., which also attacks damsons, was reported on plum shoots from Co. Longford in July 1915. The garden chafer, *Phyllopertha horticola*, L., damaged young apples by gnawing them in Co. Galway, in June 1915, and similar injury was reported by Theobald in the south of England. The clay-coloured weevil, *Otiorrhynchus picipes*, F., was especially abundant in the orchards of Co. Tyrone during May and June 1914. The best means of control was found to be shaking them off the trees on to cloths laid on the ground, though after the foliage was out this was only done with difficulty owing to their capacity for clinging to the leaves. Apple foliage was damaged by the large caterpillars of the eyed hawk-moth, *Sphinx* (*Smerinthus*) *ocellatus*, L., in August 1915 in Co. Kerry, and by the caterpillars of the apple leaf-miner, *Lyonetia clerkella*, L., in Co. Louth in November 1914. The latter eat long winding tunnels through the green tissue of the leaves. The moths live through the winter in sheltered cracks and under rubbish, and in April the female lays one egg on each leaf. After about a month the larvae emerge and spin silken cocoons on the leaves, the moths appearing in June and July. From the eggs of these a second brood of caterpillars is developed, which feeds in July and August and gives rise to a third generation, feeding in September and October and hibernating as adults. Nothing but hand-picking and burning the leaves can be recommended for their destruction, though spraying in April with paraffin emulsion might prevent egg-laying. Reports of damage to tulip bulbs by the root mite, *Rhizoglyphus echinopus*, Furn. & Rob., and the white spring-tail, *Isotoma tenella*, L., were received in May 1915 from Co. Dublin.

The green leaf weevil, *Phyllobius viridiaereus*, Laich., was found eating the leaves of climbing-roses, and the black vine weevil, *Otiorrhynchus sulcatus*, F., injured ferns in June 1915 in Co. Dublin. Caterpillars of the winter moth, *Cheimatobia brumata*, L., were also found feeding on rhododendron leaves, a new food-plant. The damage was promptly stopped by spraying with lead arsenate. In November 1914 tulip bulbs destroyed by young caterpillars of a swift moth, *Hepialus* sp., were received from Co. Dublin. In June 1914 the hazel weevil, *Strophosomus coryli*, F., was found feeding on larch in Co. Wicklow, and in May 1915, the same species together with the leaf weevil, *Phyllobius argentatus*, was reported from Co. Antrim on the same tree. The best remedy is to shake them off the branches on to cloths or boards and kill them. If the size of the plantation permits of spraying, an arsenical wash should be tried, as the beetles feed by devouring the solid leaf-tissue.

Casoria (M.). **Notes sur un Insecte Ravageur des Pommes de Terre.** [Notes on an Insect Pest of Potatoes.]—*Bull. Union Agriculteurs d'Egypte, Cairo*, xv, no. 120, June-July 1917, pp. 77–81. [Received 11th September 1917.]

The author records the sudden wilting of many plants of his potato crop early in 1917. This proved to be due to the attacks of a Pyralid, *Euzophera osseatella*, Tr., which occurs in Egypt, its usual food being the egg-plant, and not, as was feared, to a pest imported from Cyprus on the seed potatoes. The larva perforates the stem at the level of the soil and bores upwards for about an inch. As soon as the plant begins to wither, it deserts it for another one, ultimately spinning its cocoon in the stem. The adult moth emerges in 15–20 days. The eggs, which are very minute, can be discovered only with great difficulty and the only remedy seems to be the pulling up of the plants, which should be sprinkled with petrol and burnt.

Codlin Moth.—*Agric. Gaz. N. S. W., Sydney*, xxviii. no. 7, July 1917, p. 504.

Early in 1916 some publicity was given to the success attending the experimental treatment of his orchards adopted by a fruit-grower against the attacks of the codling moth [*Cydia pomonella*]. This consisted in carefully removing all the soil from the roots of the apple trees for a radius of three feet, and leaving them fully exposed all the winter to the action of frost and rain. In the spring, three kerosene tinfuls of sheep droppings were spread over the roots and covered with a layer of soil, the result being the complete absence of the moth over the three acres thus treated. Fearing that this might lead apple-growers to neglect spraying with lead arsenate, as required by the Fruit Pests Act, the Director of Agriculture arranged that comparative tests of the two methods should be carried out on an experiment farm. Six trees, treated as above, yielded up to the 28th December 1916, 423 moth-infested apples and 13 larvae found in the bandages, while six similar and neighbouring trees that had been sprayed with arsenate of lead yielded 10 living larvae in the apples, and one in the bandages.

Froggatt (W. W.). **A Descriptive Catalogue of the Scale Insects (Coccidae) of Australia.**—*Agric. Gaz. N. S. W., Sydney,* xxviii, no. 7, July 1917, pp. 505–514.

The sub-family Brachyscelinae contains the typical gall-making Coccids, the males and females developing within the galls simultaneously with the growth of the aborted woody tissue.

The species described are:—*Apiomorpha attenuata*, Frogg., and *A. bäuerleni*, Frogg., on an undetermined species of *Eucalyptus*; *A. conica*, Frogg., on *Eucalyptus*; *A. cucurbita*, Full., on *Eucalyptus uncinata*; *A. dipsaciformis*, Frogg., on *Eucalyptus*; *A. duplex*, Schrader, on several species of *Eucalyptus*; *A. excupula*, Full., on *Eucalyptus*; *A. fletcheri*, Full., on *Eucalyptus rostrata* (red gum), *E. bicolor* (box gum), and *E. regnans.*

Troop (J.). **Report of the Entomological Department.**—*Twenty-ninth Ann. Rept. Purdue Univ. Expt. Sta. for Year ending 30th June 1916, Lafayette, Ind.*, pp. 41–42. [Received 5th September 1917.]

The codling moth [*Cydia pomonella*] was less destructive to the apple crop of 1915 than usual, owing perhaps to seasonal influence or to the presence of parasites. Experimental observations by means of breeding cages and in the orchard were made in order to determine the exact time at which to apply the second spray mixture. It was found that the moths emerged over a period of more than two weeks; hence the application of the spray would be most efficacious if begun when about one-half of the adults had emerged, since about 11 or 12 days usually elapse between the emergence of the adults and the entrance of the larvae into the fruit.

An unusual outbreak of flea-beetles occurred on maize, the surface being scraped from the leaves and holes eaten through them, when the plants were two to four inches high. As usual, they were also very numerous on potatoes.

Experiments were made on the use of proprietary washing powders as insecticides, several common household kinds being tried against cabbage Aphids. It was found that only one or two fulfilled the three requirements of spreading well, killing the insects on contact, and doing no injury to the plant.

Greene (C. T.). **Two New Cambium Miners (Diptera).**—*Jl. Agric. Research, Washington, D.C.*, x, no. 6, 6th August 1917, pp. 313–317, 1 plate.

The new cambium miners described in this paper are *Agromyza aceris*, sp. n., reared from red maple (*Acer rubrum*), and *A. amelanchieris*, sp. n., from service berry or shad-bush (*Amelanchier canadensis*). The trees attacked are apparently healthy and infested ones cannot be detected by their outward appearance, as the larvae mine in the cambium of the living tree, leaving a scar known as a "pith-ray fleck," which can be detected only by removing the bark and exposing the cambium.

Both species mine downwards in the cambium of the trunk and roots of the plant attacked, and, after reaching maturity, make their exit, pupating in the ground about ½ to 1 inch to the side of the exit

hole. Full-grown larvae of *A. aceris* were collected from mid-July to mid-August, pupation taking place during the latter part of August. The flies remained in the pupal stage during the winter, the adults emerging from 24th to 26th April. In the case of *A. amelanchieris*, full-grown larvae were collected a month earlier ; the time of pupation is unknown, but the adults emerge about a week earlier than in the former species.

BETHUNE (C. J. S.). **Insects affecting Vegetables.**—*Ontario Dept. Agric. College, Toronto,* Bull. no. 251, July 1917, 32 pp., 44 figs. Received 6th September 1917.]

This is a popular manual describing the common vegetable pests in Canada and the remedies that experience has proved to be the most effective in each case.

HECKE (G. H.). **Citrophilus Mealybug Problem.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vi, no. 8, August 1917, p. 337.

The Citrophilus mealy-bug [*Pseudococcus citrophilus*] is probably the most dangerous insect pest of citrus in California, and any possibility of eradicating it that there may have been in the past no longer exists. Hence the necessity for evolving some satisfactory method of control, towards which end co-operative experimental work is being carried out by means of spraying, washing, fumigation, quarantine and control by natural enemies.

EHRHORN (E. M.). **Division of Plant Inspection.**—*Hawaiian Forester and Agriculturist, Honolulu,* xiv, no. 5, May 1917, pp. 119–120. [Received 7th September 1917.]

During the month of March a case of orchids from Guatemala was found infested with the palm aphis, *Cerataphis lataniae,* and a mealy-bug, *Ceroputo* sp. The packing contained a nest of ants, *Pheidole* sp., and a black weevil. The packing of fruit trees and ornamental plants from Japan contained a colony of ants, *Prenolepis* sp. Packages of tree seeds from Argentina were infested with weevils. A package of mantis eggs from Japan was refused delivery to a resident, on the grounds that this insect, though a beneficial species, is such a general feeder that it was thought best not to introduce it into the islands.

GRAY (G. P.). **Lead Arsenates, Stone Fruits and the Weather.**—*Jl. Econ. Entom., Concord, N.H.,* x, no. 4, August 1917, pp. 385–392, 1 plate.

Prune and apricot trees sprayed with acid lead arsenate to control canker worms in the spring of 1915 were found a few weeks later to have their foliage badly injured ; stone fruits showed injury to a greater or less extent, while apples and pears sprayed under the same conditions showed no injury. Samples of the lead arsenate examined during the investigation were of good quality and showed no unusual quantities of water-soluble arsenic. The weather during and after the spraying was damp and misty, and it seems reasonable to conclude that the acid type of lead arsenate, often labelled "standard," is

unsafe to use on the foliage of stone fruits except under favourable weather conditions, damp weather causing decomposition of the arsenate. The basic type of lead arsenate, usually labelled "triplumbic" or "neutral" is a safer arsenical to use on these fruit trees, as it is not decomposed by unfavourable weather conditions. It is, however, a slower poison than the acid type and would not be as effective unless applied when the canker worms are very young. Banding the trees with tanglefoot is also recommended for combating both the spring [*Palaeacrita vernata*] and the autumn species [*Alsophila pometaria*].

Boncquet (P. A.) & Stahl (C. F.). **Wild Vegetation as a Source of Curly-Top Infection of Sugar Beets.**—*Jl. Econ. Entom., Concord, N.H.*, **x**, no. 4, August 1917, pp. 392–397, 2 plates.

The identity of the specific organism responsible for the curly-top condition of sugar beets has long been an unsolved problem. It was known that the Jassid leaf-hopper, *Eutettix tenella*, Baker, played some part in the dissemination of the virus, and experiment showed that a single leaf-hopper in any stage was capable of producing the curly-top condition by feeding on a healthy beet for two minutes. Insects reared from the egg on healthy beets were unable to produce the characteristic condition; the ability to cause the symptoms was acquired only by feeding on affected beets, and this ability was lost in from 15 to 35 days, if the insects were transferred daily to healthy beets. A period of incubation, dependent on temperature and lasting at least two days, was required. The spasmodic occurrence of curly-top outbreaks in isolated desert regions, where beets had never before been grown, suggested that the virulent factor resided in food-plants other than beet and was perpetuated by these plants. Recent investigation and experiment have shown that *Malva rotundifolia* (mallow), which is a common weed in beet fields, is at least a symbiotic host of the virulent factor of curly-top in sugar beets.

Tucker (E. S.). **Relation of the Common Root Maggot (*Pegomyia fusciceps*, Zett.) to certain Crops in Louisiana.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 4, pp. 397–406.

Chortophila (*Pegomyia*) *fusciceps*, Zett., was first found injuring the stems of young tomato plants in 1914, the larvae piercing the stems and burrowing in them until the plant was too weakened to stand upright. A great many tomato plants were destroyed as a result of this damage. Garden peas were also attacked, but seemed able to withstand the injuries. Seed potato tubers were found badly infested with the maggots, and this was explained by the fact that the ground had been prepared for the potatoes by a fertiliser composed of decaying cotton seed, which in all probability was infested before use. Young maize and onions have also been attacked.

In the case of tomato plants, tobacco powder scattered on the beds was a promising method of control and this material is said to act as a fertiliser as well as being a repellent. The use of a trade preparation called Pyrox seemed to afford almost complete protection to the growth. The seed potatoes might have been protected by spraying

the sprouts with a solution of lead arsenate, preferably combined with Bordeaux mixture, before the maggots had time to reach the seeds. Infested onions should be pulled up to kill the maggots before they can develop into flies.

BURKE (H. E.). **A Buprestid Household Insect** (*Chrysophana placida*, **Lec.**)—*Jl. Econ. Entom., Concord, N.H.*, x, no. 4, August 1917, pp. 406–407.

During 1916, *Chrysophana placida*, Lec., which is normally a pest of dead wood or tops and scars in the trunks of living trees, has been observed infesting window-frames in a Californian city, the wood being riddled by the mines of the insect. The casings were composed of *Pinus lambertiana* (sugar pine), and it has also been found burrowing in cones of *Pinus attenuata* (knobcone pine). This Buprestid beetle lives in the wood in the larval stage for two or three years, pupates in the wood and transforms to an adult from August to November. The adult hibernates in the pupal cell and emerges from the wood in the following spring or summer. The distribution of this species in the U.S.A., and a list of the host-trees, which include many species of pine, hemlock, spruce and fir, are given.

GARMAN (H.). **A Few Notes from Kentucky.**—*Jl. Econ. Entom., Concord, N.H*, x, no. 4, August 1917, pp. 413-415.

The life-history of the Hessian fly [*Mayetiola destructor*] is being studied in western Kentucky. Adults have been found after the end of March on wheat sown on 28th September. The author is of opinion that a brood of adults matures in the autumn in this region; it is hoped to verify this next year.

Crepidodera rufipes (red-legged peach flea-beetle) was reported as gnawing the leaves of peach trees and being difficult to destroy with the customary doses of arsenate of lead.

American foulbrood is very prevalent in and about the cities and it is hoped that inspection of apiaries will soon be enforced by law. The Tenebrionid, *Blaps mucronata*, has been found in stored grain. Investigations in regard to *Cyllene robiniae* (locust borer) are being carried on.

ROCKWOOD (L. P.). **An Aphis Parasite feeding at Puncture Holes made by the Ovipositor.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 4, August 1917, p. 415.

An observation is recorded of an individual of *Aphelinus lapisligni* parasitising *Aphis bakeri* on clover, which, having inserted its ovipositor three times into the body of the aphis, turned round and placed its mouth to the wound, apparently feeding on the exuding juices. This habit has previously been recorded in connection with other parasitic Hymenoptera and other hosts, but apparently never before in the case of an Aphid.

PATCH (E. M.). **Eastern Aphids, new or little known. Part I.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 4, August 1917, pp. 417–420, 1 fig.

The species described in this paper from the Eastern United States include: *Aphis viburniphila*, sp. n., found on many species of *Viburnum*; this species is largely parasitised by Hymenoptera; *A. rumexicolens*, sp. n., found on *Rumex acetosella*; *A. saliceti*, Kalt., found on various Umbelliferae as well as on willow, which was the only previously-known host; *A. davisi*, n. n., is proposed for the species recorded by Davis as *A. populifoliae*, Fitch (*Journal of Economic Entomology*, Vol. 3, p. 489), as according to Baker, Fitch's insect is a species of *Pterocomma*; *Prociphilus xylostei*, De G., on *Lonicera*; and *Lachnus rosae*, Chol., on wild rose; this species has not previously been recorded from America.

BAKER (A. C.). **Eastern Aphids, new or little known. Part II.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 4, August 1917, pp. 420–433, 1 fig.

This paper includes the following species: *Myzocallis punctatellus*, Fitch, on oak; this species has been erroneously treated as a synonym of *M. caryella*, Oest.; *M. alnifoliae*, Fitch, on alder, frequently incorrectly recorded as the European *M. alni*, F.; *M. californicus*, sp. n., on *Quercus lobata*; *M. fumipennellus*, Fitch (*caryaefoliae*, Davis), an apparently rare species for which no host is given; *M. tiliae*, L., on *Tilia*; *Monellia costalis*, Fitch, on hickory leaves; *Euceraphis betulae*, Koch (*cerasicolens*, Fitch), on Japanese maple; *E. mucidus*, Fitch (*pinicolens*, Fitch), on black birch; *E. brevis*, sp. n., on white birch; *E. lineata*, sp. n., and *E. deducta*, sp. n., on birch; *Callipternella annulata*, Koch, on various species of birch; *Chaitophorus lyropicta*, Kess, on Norway maple, frequently recorded as *C. aceris*, L.; *C. americanus*, sp. n., on maples; *C. viminalis*, Mon., on *Populus grandidentata*; *C. nigrae*, Oest. (*cordata*, Wms.), on willow; *C. bruneri*, Wms., on poplar; and *Pterocomma media*, sp. n., on poplar.

Keys are given to the American species of the various genera.

ESSIG (E. O.). **The Tomato and Laurel Psyllids.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 4, August 1917, pp. 433–444, 1 plate, 2 figs.

Some fifty species of Psyllids occur in California, only two, the tomato Psyllid, *Paratrioza cockerelli*, Sulc., and the laurel Psyllid, *Trioza alacris*, Flor, being considered of economic importance. The former is widely distributed in the State, mainly infesting Solanaceous food-plants, but also attacking others. Hibernation takes place in the adult stage on evergreen plants. Oviposition occurs from April until late in the year, so that all stages are found from May to November. When infestation becomes serious, which is seldom the case, care must be taken to use a spray that will not injure the delicate food-plants. Nicotine sulphate or Blackleaf 40 may safely be used at the rate of 1 : 1,000 or 1,500. In Colorado, lime-sulphur proved the only successful control on tomatoes; used in the proportion 1 : 40 the Psyllids were killed without injury to the plants, though potatoes were seriously damaged by this spray.

Trioza alacris is at present limited to a few localities and is a potential enemy of sufficient importance to warrant every effort being made to eradicate it while the distribution is still limited. Hibernation occurs in the adult stage upon the food-plants. Eggs are laid in spring on the small leaves of tender shoots of laurel, where the nymphs produce galls, which they desert at maturity and leave to the depredations of other insects such as *Pseudococcus.* There are several broods in the year, the last one maturing in October and November. Control is difficult owing to the waxy secretion with which the insects are covered and the habit of the nymphs of hiding in the galls. Fumigation effectually kills the eggs and nymphs, and during winter, when only adults are present, plants may be removed to a fumigating house for treatment, and if kept from re-infestation for a few months, can then be re-shipped. Spraying with miscible oils and oil emulsions readily kills all stages, if repeatedly and thoroughly applied.

HOLLAND (W. J.). *Hymenia perspectalis*, **Hübner, a Greenhouse Pest.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 4, August 1917, p. 446.

The larvae of *Hymenia perspectalis* are recorded as having done considerable damage to young plants of *Alternanthera.* If allowed to increase in greenhouses, this moth might become a serious pest.

WEISS (H. B.). *Megastigmus aculeatus*, **Swed., introduced into New Jersey from Japan.**—*Jl. Econ. Entom., Concord, N.H.*, x, no. 4, August 1917, p. 448.

Seeds of *Rosa multiflora* that had failed to germinate were found to be heavily infested with a Chalcid identified as *Megastigmus aculeatus*, and examination showed that nearly every shipment consigned to New Jersey from Japan during the spring of 1917 was similarly infested. The larva apparently destroys the entire interior of the seed, leaving nothing but the hard outer covering.

MCNAIRN (W. H.). **Birds in Relation to Agriculture.**—*Seventeenth Ann. Rept. Agric. Societies of Ontario for Year 1917, Toronto*, 1917, pp. 28–35, 5 figs. [Received 4th September 1917.]

The author points out that man, having destroyed the balance of nature by practically exterminating many plant-eating and carnivorous animals, while increasing the numbers of certain plants, such as grain-producing species, and of certain mammals, such as cattle, requires all the assistance that science can offer to combat the vast hordes of enemies which would otherwise rapidly involve him in pestilence, famine and death. In the face of the depredations caused by insects in growing and stored grain, no more effective allies are available than birds. Those mentioned in this paper are classed under the headings of birds that destroy mice and vermin, those that feed mainly on insects and those that eat weed seeds.

HUTSON (J. C.). *Diaprepes abbreviatus.*—*Agric. News, Barbados*, xvi, no. 399, 11th August 1917, p. 251.

The varieties of *Diaprepes abbreviatus* occurring in St. Lucia are *D. abbreviatus quadrilineatus* and *D. abbreviatus punctatus*, the latter having recently been taken on the leaves of lime trees.

JARVIS (E.). **The Cane Beetle.**—*Queensland Agric. Jl., Brisbane,* viii, no. 1, July 1917, pp. 37–38. [Received 11th September 1917.]

While ploughing cane-land during April and May large numbers of small grubs about $\frac{3}{4}$ in. long are turned up, together with third stage larvae of the greyback cane beetle, *Lepidiota albohirta,* about $1\frac{3}{4}$ in. in length. Most sugar-planters erroneously believe the former to be the young larvae of this species which have emerged from eggs laid during the current season, and the latter to be the full-sized grubs, hatched the previous year. These small grubs are in fact the second stage larvae of *L. frenchi,* a destructive Scarabaeid beetle, whose metamorphosis occupies two years, while the complete life-cycle of *L. albohirta* takes only 12 months. *L. frenchi* feeds on the roots of cereals and other herbaceous plants, but has already acquired a liking for cane, the fully-grown grubs being usually mistaken for those of *L. albohirta.* Although one of the more serious cane pests, second perhaps to *L. albohirta* in economic importance, *L. frenchi* fortunately oviposits, as a rule, in uncultivated soil that is densely covered with grass or weeds. Since both *L. frenchi* and *L. albohirta* oviposit during December and January and are strongly attracted by luxuriant vegetation between the rows, the surest means of control lies in maintaining a system of clean culture on land intended for an early crop. If fallow land is ploughed up for an early crop in May or April, the young grubs are apt to be overlooked, and the weeds being then destroyed, the young larvae are obliged to subsist almost entirely on the roots of sugar-cane.

Les Hannetons de la Canne à Sucre au Brésil. [Sugar-cane Cockchafers in Brazil.]—*Rev. Scient., Paris,* lv, no. 1, 6th January 1917, p. 20.

Sugar-cane plantations in the eastern part of Brazil are attacked by the larvae of the beetles, *Ligyrus fossator* and *Podalgus humilis,* which are also met with in French Guiana. These larvae, which prefer moist conditions, pierce the bases of young shoots and hinder their development. Suggested means of combating them include submersion for 48 hours to kill the larvae, the capture of the adult insects by means of lamps placed above tubs of petrol, the payment of rewards for insects collected, and the injection of carbon bisulphide into the subsoil at the rate of nearly 1 oz. per square yard. In cases of severe infestations, a rotation of crops to deprive the pests of their favourite host-plants is recommended. The scale, *Pseudococcus citri,* is controlled by plunging the cane-cuttings for 20 minutes into a 2 per cent. emulsion of soap and petrol, or into a solution of calcium sulphide at 5 degrees Bé.

ROTHSCHILD (Lord). **Supplemental Notes to Mr. Charles Oberthür's Faune des Lepidoptères de la Barbarie, with Lists of the Specimens contained in the Tring Museum.**—*Novitates Zoologicae, Tring,* xxiv, no. 2, August 1917, pp. 325–373.

On p. 355 of this paper. the synonymy of the gold-tail and brown-tail moths is discussed. The gold-tail moth has hitherto been generally known under the name *Porthesia similis,* Fuess., but the name given to this insect by Linnaeus was *Phalaena chrysorrhoea,* L., though

for the last hundred years this name has been applied in error to the brown-tail moth. Linnaeus' description of the adult insect might apply to either species, but that it was the gold-tail he was describing is proved by the fact that he quotes an earlier description by Joannis Raius (1710) which states that the larva has three scarlet lines above the feet on each side of the body, a character that occurs in the gold-tail and not in the brown-tail. The specific name *chrysorrhoea* must therefore be reserved for the gold-tail and another name must be found for the brown-tail. The earliest description of the brown-tail is by Esper (1785) under the name *auriflua*, but this cannot be adopted because the gold-tail had been previously described under it by Schiffermüller and Denis. The next description is that of Donovan (1813) who called it *Phalaena phaeorrhoea*.

The change in specific nomenclature also necessitates a revision of the generic names. This question is discussed at length, the gold-tail being placed in the genus *Arctornis*, Germ. (1811), and becoming *Arctornis chrysorrhoea*, L., and the brown-tail in the genus *Nygmia*, Hb. (1832), the correct name for it being therefore *Nygmia phaeorrhoea*, Don.

Speyer (E. R.). **Summary Report on the Work of the Entomological Division.**—*Ceylon Administration Reports for 1916*, Part iv. Dept. Agric., 1st February 1917, pp. C 7–8. [Received 11th September 1917.]

The following tea pests have been investigated during the year under review: *Homona coffearia* (tea tortrix) has been very severe in some localities. *Orgyia postica* (small tussock moth) has been reported in the caterpillar stage in January and October, and the fringed nettle grub [*Natada nararia*] in May and July. *Zeuzera coffeae* (red borer) occurred on many occasions between January and November in various localities; in one district the borers were heavily parasitised by Braconids which were hatched from the cocoons in November. Psychid bagworms were reported in October. *Xyleborus fornicatus* (shot-hole borer) has been checked in many districts and in some localities showed a marked decrease due to climatic conditions, while in others it increased locally. Two other Scolytids, markedly smaller than the true shot-hole borer, have been recorded in tea. *Astycus* sp. (tea weevil) was reported in March and *Arbela quadrinotata* (bark-eating borer) in January. The Fulgorid, *Ricanoptera opaca*, apparently a new pest of tea, was reported in May, the outbreak lasting only a short time. *Coccus* (*Lecanium*) *viridis* was found in August in small numbers attacking tea. Tea mites were much in evidence during the long drought in the early part of the year, but disappeared with the coming of the rains, the most abundant being *Eriophyes* (*Phytoptus*) *carinatus* (purple mite). A case is recorded of tea infested with Psocids; it is probable that the insects were originally present on the wood of the tea chests and thus obtained admittance to the tea.

On rubber, no serious pests have been recorded. *Hevea* was attacked in January and February by the small, bark-eating caterpillars of *Comocritis pieria*. Acacias were attacked by *Icerya purchasi* (fluted scale).

SPEYER (E. R.). **Report of Entomologist in Charge of Investigations into Shot-hole Borer of Tea.**—*Ceylon Administration Reports for 1916*, Part iv, Dept. Agric., 1st February 1917, pp. C 8–9. [Received 11th September 1917.]

Tea-fields are being treated by experimental methods for combating *Xyleborus fornicatus.* In some, all branches are to be cut off which do not put out new shoots in from two to four months after pruning; others are to have the infested bushes pruned at stated times after the original pruning; the results will not be apparent for 18 months in the case of the first method and two years in the case of the second. An examination of tea-prunings buried with basic slag and sulphate of potash showed that two months after burying prunings to a depth of 1½ ft. the beetles were still breeding underground and were evidently finding their way to the surface. The system of burying prunings on estates is therefore deprecated and the burning of the woody parts recommended. The experiment of breaking branches attacked by the borer and leaving them attached to the bushes proved that the exposure of portions of the galleries does not hinder the development of the beetle in other parts not exposed.

Experiments were begun in October 1915 with 12 washes, made of various proportions of resin, soda, creosote, fish-oil and carbolic acid, which were applied to plots of 15 newly pruned tea bushes. Four washes were found to be too thin in composition to protect the wood from the borer. The others formed a varnish which would definitely prevent entry or emergence of the insects. Six of these washed off too easily with the monsoon rains. The remaining two were temporarily satisfactory, but after four months the bushes thus treated had made no growth; the experiment was not therefore proceeded with. In January 1917, these bushes were found to have recovered completely and further experiments are now being made with washes which may act as a protection to young buds. *Ricinus communis* (castor-oil plant) was found to be useless as a trap for the borer; for though it becomes heavily infested, it does not thereby reduce infestation in the tea bushes.

The trunks of *Grevillea* were examined to determine what species of Scolytid beetle attacked their surface after removal of the bark. After 18 days, 31 beetles were extracted from the cut surfaces, including 23 examples of *Xyleborus semigranosus* (?), 7 of *X. semiopacus* and only 1 of *X. fornicatus.*

SPEYER (E. R.). **Shot-hole Borer of Tea.**—*Trop. Agric., Peradeniya*, xlix, no. 1, July 1917, pp. 17–21, 1 fig.

The distribution of *Xyleborus fornicatus* (shot-hole borer of tea) in Ceylon has been effected rapidly by two definite factors, namely the removal of infested tea plants or prunings from one estate to another and the natural flight of the insect with or without the assistance of wind. The presence of the castor-oil plant, *Ricinus communis,* which is the true host-plant [see this *Review,* Ser. A, v, p. 51], has also encouraged its increase. The female constructs a branched gallery [see this *Review,* Ser. A, v, p. 282] and the life-cycle is passed within the wood. In wet seasons the development of the broods is greatly

retarded, and an excess of moisture in the plant causes an overgrowth of the fungus deposited by the beetles, which results in their death. Old dadap trees [*Erythrina indica*] are very liable to attack by the borer, particularly after having been ringed for removal. The ringed surface should be well scorched with a Swedish blow-flame from 7 to 40 days after ringing. Good cultivation over a number of years has undoubtedly rendered the attacks of the borer less serious.

Remedial measures include the cutting out and burning of all castor-oil plants and of all dieback branches, *i.e.*, those which do not put out new shoots after pruning, within 2 months at low, 3 months at medium, and 4 months, at high elevations. The woody parts of all prunings should be burnt, and branches thinner than an ordinary pencil, with the leaves, should be used as a mulch. The ash of the burnt wood should be spread over the field for manurial purposes. All methods of slashing or cutting across, whether done to prolong the flushing of a field or to bring young trees into bearing, should be strictly avoided, as tea thus treated has frequently been found liable to the heaviest attack. Liberal application of manure is recommended; green manure plants should be kept as low as possible and they should be lopped at the same time as the cutting off of the diebacks.

Brand (E.). **Coconut Red Weevil. Some Facts and Fallacies.**—*Trop. Agric., Peradeniya,* xlix, no. 1, July 1917, pp. 22–24, 3 plates.

The author offers several observations on *Rhynchophorus ferrugineus* (coconut red weevil) in connection with a previous paper on this insect [see this *Review*, Ser. A, v, p. 326]. This weevil is a much more serious pest of coconuts than *Oryctes rhinoceros* or *O. monoceros* (rhinoceros beetles), to which far more attention has been paid, while some of the descriptions of its habits are inaccurate. Although it has been described as nocturnal in habit, the author has observed the mature insects flying round coconut palms after sunset and in cloudy, warm weather at any time of day. He records having been obliged to cut down infested trees in full bearing and laden with fruit, although it has been said that the weevil does not attack sound trees. He also states that the insect attacks the base of a tree and works upwards, which is contrary to previous assertions. The essential differences in the habits of *R. ferrugineus* and of *O. rhinoceros* are stated. Adult rhinoceros beetles feed on the succulent portions of the coconut stem head, called the cabbage of the palm, while the adult red weevil is not known to feed at all. The larvae of the rhinoceros beetle feed on dead or decaying vegetable matter, but the larvae of the palm weevil must have living, fresh tissue, preferably the interior of coconut stems or the whitish base of the leaf-stalk. The rhinoceros beetles rarely kill the palms, the chief damage they do lying in the fact that they afford a means of ingress to *R. ferrugineus*, which frequently completes the destruction of a tree within the course of a few weeks. These weevils attack the top, bottom or middle of the tree in any stage of growth. The practice of removing the leaf-stalks before they are ripe, for the purpose of clearing the field, is deprecated, as the part of the trunk underlying a leaf-stalk is a favourite spot for attack. The author has no faith in the use of carbon bisulphide, with which he has experimented extensively, as a means of destroying the

grubs. Quantities of arsenic, sodium sulphite, hypo-sulphite, and magnesium sulphate were all tried without much success. Preventive measures are therefore advocated. When a tree has of necessity been probed and the grubs cleared out of the tunnels, every exposed wound must be covered up. For this purpose, filling in with lime mortar has been found more effectual than tarring the surfaces, particularly when a preliminary spraying with paraffin emulsion has been made. These mutilated stems are always a source of danger and the utmost care should be taken that no stems remain in which the weevils may be present in the pupal stage.

Henry (G. M.). **The Paddy Cutworm,** *Spodoptera mauritia,* **Boisd.**—*Trop. Agric., Peradeniya,* xlix, no. 1, July 1917. pp. 32–33, 1 fig.

The earliest outbreaks of *Spodoptera mauritia* in Ceylon were recorded in 1904–1906; since then the pest has been practically quiescent until the present time, when it seems to have increased suddenly, causing a serious and widespread outbreak. This cutworm has the marching habit, the caterpillars migrating in swarms over the ground in search of fresh fields, which they entirely devastate. The best remedy therefore is to dig trenches round the fields adjacent to the outbreak, in which the migratory caterpillars collect in hordes and can be easily killed. The infested fields should be flooded and the caterpillars then disturbed by dragging a rope, stretched between two men, over the rice; this causes the insects to fall off the plants into the water where they are drowned. During slight infestations in 1914 and 1915, the pest was controlled by spraying the crop with lead chromate.

Under normal conditions the insects occur in small numbers in neglected grass-lands; all wild grasses adjacent to rice-fields should therefore be carefully looked after to prevent this cutworm from increasing unduly.

As the moth lays its eggs in batches on grass-blades and as the caterpillar hides by day and pupates underground, infested grass-lands should be ploughed in order to bury the eggs and expose the caterpillars and pupae to predaceous birds before rice-planting begins. As the caterpillars apparently eat only young rice, the damage might be prevented by growing the seedlings in nurseries protected by ditches full of water and transplanting as soon as the plants are big enough to resist attack.

Newstead (R.). **Observations on Scale-Insects (Coccidae)–iv.**—*Bull. Entom. Research, London,* viii, no. 1, August 1917, pp. 1–34, 2 figs.

The following new species are described :—*Llaveia abrahami*, from British Guiana, where it inhabits indentations in the bark of a rubber-producing tree, *Sapium jenmani*, and is attended by ants which construct coverings over it; *L. primitiva* var. *pimentae*, from Jamaica on *Pimenta officinalis*, attended by the so-called stinking-ant, *Cremastogaster* sp.; *Aspidoproctus neavei*, sp. n., from Nyasaland; *A. verrucosus*, sp. n., from Uganda, on a fig-tree; *Palaeococcus bicolor*, sp. n., from the Gold Coast, on *Thespesia* sp.; *P. caudatus*, sp. n., from Uganda, on crotons; *P. cajani*, sp. n., from

S. Nigeria, on pigeon-pea; *Icerya nigroareolata*, sp. n., from Uganda, on coffee and croton; *I. sulfurea* var. *pattersoni*, n., from the Gold Coast, on *Tectona* sp.; *Margarodes buxtoni*, sp. n., from Algeria; *Stictococcus intermedius*, sp. n., from the Gold Coast, on cacao; *Asterolecanium spectabile*, sp. n., from Mauritius, on palm trees; *Lecaniodiaspis tarsalis*, sp. n., from S. Africa; *Phenacoccus ballardi*, sp. n., from S. India, on mango; *Tachardia bodkini*, sp. n., from British Guiana, on *Sapium jenmani*; *Pulvinaria aristolochiae*, sp. n., from the Gold Coast, on *Aristolochia* sp.; *P. elongata*, sp. n., from British Guiana, on sugar-cane; *P. subterranea*, sp. n., from Uganda, on roots of *Chrysanthemum*; *P. africana*, sp. n., from the Gold Coast, on guava, many of the examples being attacked by a parasitic fungus and preyed upon by a Lepidopterous larva; *Ceroplastes avicenniae*, sp. n., from British Guiana, on *Avicennia nitida*; *C. bipartitus*, sp. n., from S. Africa; *C. destructor*, sp. n., from Uganda; *C. lamborni*, sp. n., from Southern Nigeria, on cacao; *C. subdenudatus*, sp. n., from Uganda, on *Acacia*; *C. zonatus*, sp. n., from S. Africa; *Inglisia theobromae*, sp. n., from Uganda, on cacao pods and flowers.

Descriptions are also given of *Monophlebus ? hirtus*, Brain, from Nyasaland; *Stictococcus gowdeyi*, Newst., from Southern Nigeria, on young shoots of cacao, invariably protected by the ant *Oecophylla*; *S. multispinosus*, Newst., from S. Nigeria, on pigeon-pea, and from Uganda, on *Markhamia platycalyx*; *Pulvinaria ? flavicans*, Mask., from British Guiana, on "blood-wood" plant; *Ceroplastes egbarum*, Ckll., from the Gold Coast, on *Pithecolobium saman*; and *C. vuilleti*, March., from S. Nigeria, abundant on pigeon-peas.

WATERSTON (J.). **A New Species of *Paraphelinus*, Perk., from British Guiana, with a Discussion of the Genus and the Allied *Aphelinus*, Dalm.**—*Bull. Entom. Research, London*, viii, no. 1, August 1917, pp. 43–58.

The genus *Paraphelinus* is of economic importance owing to the fact that its members destroy the eggs of *Xiphidium* and *Tomaspis*, while most APHELININAE attack Aphids, Coccids and Aleurodids.

P. xiphidii, Perkins, efficiently controls the grasshopper, *Xiphidium varipenne*, Swez., the eggs of which it attacks after they have been laid in clusters beneath the leaf-sheath of the sugar-cane. Its life-cycle varies from 20–31 days, that of the host being three months, which places the parasite at a distinct advantage. This parasite was first observed in 1905, in the grounds of the Hawaiian Sugar Planters Association's Experiment Station, Honolulu, where it had almost certainly been introduced. Examples of this Chalcid have been found both in Trinidad and British Guiana, during investigations on the natural enemies of *Tomaspis* in order to find an effective control of the froghopper, *T. saccharina*, Dist. Experiments have shown that *P. xiphidii* bred as a hyper-parasite from cocoons of a Dryinid, *Haplogonatopus*, Perk., readily attack the eggs of *Xiphidium*, but the resulting imagines quite as freely reverted to *Haplogonatopus*; this is unfortunate, since it is desirable to protect this Dryinid enemy of leaf-hoppers. *Xiphidium varipenne* itself, though a noxious insect in its destruction of young shoots, stamens, etc., is also useful as it devours Aphids.

Other species of *Paraphelinus* dealt with are :—*P. tomaspidis*, How., from eggs of *Tomaspis varia* in Trinidad ; *P. perkinsi*, sp. n., from *Tomaspis ? carmodyi* in British Guiana ; *P. speciosissimus*, Gir., from Illinois ; *P. australiensis*, Gir., from Queensland ; and *Paraphelinus* (*Agonioneurus*) *locustarum*, Giraud, from eggs of *Xiphidium fuscum.*

WILLIAMS (C. B.). **A New Thrips damaging Orchids in the West Indies.** —*Bull. Entom. Research, London,* viii, no. 1, August 1917, pp. 59–61, 1 fig.

This paper describes *Physothrips xanthius*, sp. n., which has recently caused considerable damage to ornamental orchids in Trinidad. It is probably not indigenous to the island, as it has not yet been found on wild orchids, but may have been imported with orchids from Venezuela. The larvae and pupae are found with the adults on the upper-surfaces of the leaves, on which they cause brownish spots; in severe cases they may kill the plant.

BEZZI (M.). **New Ethiopian Fruit-flies of the Genus** *Dacus*.—*Bull. Entom. Research, London,* viii, no. 1, August 1917, pp. 63–71, 6 figs.

This paper includes a key to further African species of this genus [see this *Review*, Ser. A, iii, p. 748]. The species dealt with are : *Dacus* (*Tridacus*) *d'emmerezi*, sp. n., from Mauritius ; *D. annulatus*, Becker, from Egypt and Erythraea ; *D. mochii*, sp. n., from Erythraea ; *D. woodi*, sp. n., from Nyasaland ; *D. hamatus*, sp. n., from Nyasaland ; *D. blepharogaster*, sp. n., from Erythraea ; *D. erythraeus*, sp. n., from Erythraea.

D'EMMEREZ DE CHARMOY (D.). **Notes relative to the Importation of** *Tiphia parallela*, **Smith, from Barbados to Mauritius for the Control of** *Phytalus smithi*, **Arrow.**—*Bull. Entom. Research, London,* viii, no. 1, August 1917, pp. 93–102, 3 tables, 1 map.

The Melolonthid beetle, *Phytalus smithi*, was first detected in Mauritius in 1911 on land adjoining the Royal Botanical Gardens, suggesting its probable importation on cuttings. In the following year its natural home was found by Dr. Guy Marshall to be in Barbados. The first control measures consisted in digging out the larvae from the fields, and capturing adult insects at night from 7 to 9 p.m. The fact that the pest did not cause so much damage in Barbados as in Mauritius suggested the existence of some natural enemy. The most important of these has proved to be the Scoliid wasp, *Tiphia parallela*, which had already been recorded from Brazil. Five different attempts were made to introduce this parasite from Barbados, with indifferent results, though it was discovered later that four couples that had been liberated in 1915 had established themselves and given rise to a large number of insects. The reason that this did not occur in the insectary would seem to be due to the fact that captivity affects the longevity of the insect, and, since it lays eggs only two at a time, with an interval of at least seven days between two ovipositions, it indirectly affects its egg-laying power. Further, it appeared that the difficulty of establishment might be due to lack of proper food material, since in Barbados *Tiphia* lives on the secretions of Aphids, which in

Mauritius appear only at a certain time of year and then are rapidly destroyed by Syrphids, Braconids, Coccinellids and fungi. In Mauritius it has however had recourse to the sweet contents of the vesicular hairs of *Cordia interrupta*, a plant introduced from British Guiana about 15 years previously and now a troublesome weed in all uncultivated fields. Though it would be premature to conclude that lack of suitable food was chiefly responsible for the failure of attempts to establish *Tiphia parallela*, yet it seems necessary to make a closer study of food requirements when introducing insects from a long distance.

BODKIN (G. E.). **Notes on the Coccidae of British Guiana.**—*Bull. Entom. Research, London*, viii, no. 1, August 1917, pp. 103–109.

This paper supplements an earlier one [see this *Review*, Ser. A, ii, pp. 416–417], and gives a list of 67 species with their host-plants. Although the cost of the annual damage by scale-insects in British Guiana must be enormous, little is done by the smaller farmer to control them, though spraying is carried out with beneficial results on some of the large coconut estates.

The following species of COCCINELLIDAE, the most important enemies of scale-insects in British Guiana, are recorded:—*Pentilia insidiosa*, Muls., predaceous only on *Asterolecanium bambusae*, Bdv.; *Hyperaspis festiva*, Muls., and *H. orthopustulata*, Muls., predaceous on *Pseudococcus sacchari*, Ckll., on sugar-cane; *Brachyacantha decempunctata*, Melsh., an uncommon species predaceous on a species of *Pseudococcus*; *Neda dilychnis*, Muls., *Cryptognatha nodiceps*, Mshl., and *Azya trinitatis*, Mshl., predaceous on *A. destructor*, Sign., on coconuts; *A. pontbrianti*, Muls., a common enemy of *Saissetia hemisphaerica*, Targ. The Chryopsid, *Chrysopa claveri*, Navas, is occasionally predaceous on *Pseudococcus sacchari*.

The following Hymenopterous parasites have been bred from COCCIDAE:—*Arrhenophagus chionaspidis*, Auriv., from *Hemichionaspis minor*, Mask.; *Leptomastix dactylopii*, Howard, from *P. citri*, Risso; and *Lecaniobius cockerelli*, Ash., bred from *Saissetia nigra*, Nietn.

Saissetia nigra, Nietn., *S. oleae*, Bern., *S. hemisphaerica*, Targ., and *Ceroplastes floridensis*, Comst., are also attacked by the Lepidopterous larvae of *Blastobasis lecaniella*, Busck, and the Pyralids, *Vitula bodkini*, Dyar, and *V. toboga*, Dyar.

Two species of entomogenous fungi, well known elsewhere in the West Indies, are at times found attacking colonies of scale-insects, being more effective in the more humid districts inland; these are the red-headed fungus, *Sphaerostilbe coccophila*, principally attacking *Chionaspis citri*, and the shield-scale fungus, *Cephalosporium lecanii*, attacking *Saissetia nigra*, *S. oleae*, *S. hemisphaerica*, Targ., *Coccus mangiferae*, Green, *C. hesperidum*, L., and *C. viridis*, Green.

The following species of ants have been observed to be associated with certain COCCIDAE, viz.:—*Daceton armigerum*, Latr., attending *P. citri*, on cacao pods; *Cryptocerus atratus*, L., attending *P. citri*, *Coccus hesperidum* and *Saissetia nigra*; *C. minutus*, F., attending *Pulvinaria pyriformis*, Ckll., and *C. hesperidum*, L.; *Ectatoma tuberculatum*, Oliv., attending *Saissetia nigra*, on *Hibiscus*; *Tetramorium*

guineense, F., attending *P. sacchari* on sugar-cane and *P. citri* on cacao pods; *Azteca schimperi*, Em., attending *Lecanium aequale*, Newst., and *Ceroplastes avicenniae*, Newst., on Courida (*Avicennia nitida*); *Dolichoderus* (*Hypoclinea*) *bidens*, L., attending *P. citri*, on cacao pods; and *Solenopsis pylades*, Forel, attending *P. sacchari*; while a species of *Cremastogaster* fosters *Akermes quinquepori*, Newst.

ARROW (G. J.), DISTANT (W. L.), GAHAN (C. J.) & MARSHALL (G. A. K.). **Some Insects injurious to Cacao Plants in the Belgian Congo.**—*Bull. Entom. Research, London*, viii, no. 1, August 1917, pp. 111–118.

This paper contains descriptions of various cacao pests discovered by M. Mayné, Government Entomologist in the Belgian Congo. The Melolonthid beetles are *Aserica variegata*, sp. n., which devours the young and tender leaves; *Pseudotrochalus concolor*, Kolbe; and *Triodonta procera*, Lansb.

The Coreid bugs described are *Pendulinus devastans*, sp. n., and *P. nigromarginatus*, sp. n., an allied species found in Natal, which is probably also a destructive insect.

Two new Longicorn beetles described are *Tragocephala maynei*, sp. n., and *Exocentrus ortmansi*, sp. n.

The injurious weevils are *Systates ramosus*, sp. n., an insect stated by M. Mayné to occur but rarely, the adult attacking the leaves of full-grown trees; *S. maynei*, sp. n., which is abundant in cacao plantations and is especially injurious to young plants in the nurseries, the mature insect devouring the leaves: and *Alcides theobromae*, sp. n., which is not yet sufficiently numerous to be regarded as an important pest, though the larvae kill the small branches of cacao by boring longitudinal galleries in them.

L'Arboriculture Fruitière dans le Nord de l'Afrique. [Fruit-tree Culture in Northern Africa.]—*Bull. Agric. Algér.-Tun.-Maroc, Algiers*, xxiii, nos. 7 & 9, July-August 1917, pp. 133–158, 12 figs.

Apricot trees in northern Africa are sometimes attacked by *Ceratitis capitata* and more frequently by the larvae of *Drosophila*, but these are chiefly injurious to the late varieties grown on the coast. The larvae of the Buprestid, *Capnodis tenebrioides*, attack the roots and in some cases succeed in destroying the trees. This beetle occurs in Algeria on the coast, where it is the most serious pest of plum trees; adults should be destroyed on the trees before oviposition, if possible. As the larvae emerge from eggs laid in the fissures of the bark at the base of the trees, whitewashing the trunks in May with lime and arsenicals, such as arsenate of lead or arsenite of copper, is a good preventive measure.

In packing apricots, the fruit must be handled with as little delay as possible to prevent fruit moths from ovipositing on them. The beetle, *Sylvanus mercator*, is a particularly troublesome pest which is able to breed in the boxes.

DE JOANNIS (J.). **Un nouveau Méfait de** *Tinea granella*, **L. (Lep. Tineidae).** [A New Form of Damage caused by *Tinea granella*, L.] —*Bull. Soc. Entom. France, Paris*, no. 13, 11th July 1917, pp. 220–221. [Received 14th September 1917.]

The damage here reported took the form of eating away the paste made of rye-flour and dextrine, by which cornices and ceiling panels, moulded in cardboard, had been fixed in position. The presence of the moths had been noticed while the work was in progress, and the following year, on a length of the cornice being removed, no trace of the paste which had filled the mouldings was to be seen, but in its place were found larval excreta and innumerable empty pupa-cases.

BRÈTHES (J.). **Un Enemigo de las Frutas: La** *Ceratitis capitata*. [An Enemy of Fruit: *Ceratitis capitata*.]—*Anales Soc. Rural Argentina, Buenos Aires*, li, no. 3, May 1917, pp. 301–303, 3 figs. [Received 12th September 1917.]

This paper contains a popular account of the history and habits of the fruit-fly, *Ceratitis capitata*, which is not at present a pest of any importance in South America, but which, on account of its cosmopolitan habits, is a potential danger to be reckoned with. The author suggests that the following remedial measures should be undertaken without delay, while the numbers are still unimportant. Dropped fruit should be collected before the insects can enter the ground to pupate. The use of various poisons to kill the flies is deprecated, as these destroy bees and other useful insects at the same time. Experimentation with natural parasites is suggested as being probably the most promising method of control. It is suggested that the present scarcity of *C. capitata* may be due to the presence of natural parasites, in which case the discovery of these parasites might be used for the benefit of other and more seriously affected countries; while, if natural parasites do not occur, such species as *Syntomosphyrum indicum*, *Dirhinus giffardi* and *Galesus silvestrii* might be introduced.

MASSINI (Dr. P. C.). **Destrucción de la Langosta: Lucha Biológica.** [Destruction of the Locust: Biological Control.]—*Anales Soc. Rural Argentina, Buenos Aires*, li, no. 4, June 1917, pp. 309–314, 1 plate.

Several species of Muscids occur in the Argentine Republic that are serious enemies of locusts; the most important of these is *Sarcophaga caridei*, Brèthes, which is a specific and exclusive parasite of *Schistocerca paranensis*. The author advocates the propagation and use of this species in the locust campaigns in that country. Brèthes' description of this fly is given and it is compared with an allied species, *Sarcophaga acridiorum*, Weyemb. The adult usually deposits a single egg on the body of each locust, the total number produced by each female being approximately 370; the larva upon hatching bores into the body of the locust by perforating some spot where the integument is thin and develops gradually at the expense of its host, without attacking the vital organs until its development is practically complete; it then bores an exit-hole and emerges and enters the soil to pupate, this stage lasting

about 20 days. When the locusts are in flight, the adults of *S. caridei* can be seen following them like a cloud. It is said that the locust recognises its enemy and tries to evade it, frequently falling to the ground in its attempts to escape.

The other enemies of *Schistocerca paranensis* are reviewed, all of which, for various reasons, are less adapted for use in control than *S. caridei.* Bacteria can be successfully used only under certain conditions: the coccobacillus of d'Hérelle [*Coccobacillus acridiorum*], for example, while very efficacious in the laboratory at 77° F., is said to be absolutely useless under the hot sun of Santa Fé or on a soil heated to 132° F. While, therefore, these methods are useful as accessory means of control when used under expert direction in certain years and under favourable climatic conditions, they cannot be counted on as reliable. *Sarcophaga caridei*, on the other hand, is harmless to agriculture, animals and man, has great powers of reproduction and resistance, and is adaptable to various regions and climates, including all those districts in which *Schistocerca paranensis* occurs in Argentina.

The method of collection and propagation is as follows. Parasitised larvae of *S. paranensis* are collected and stored on wooden or cement floors. When the mature larvae of *Sarcophaga caridei* emerge from their hosts, they are unable to enter the ground to pupate and the pupae can then be collected and transported to those districts where locusts are troublesome. The author emphasises the economy and utility of this method and hopes that its adoption will not be delayed with disastrous results, as happened in the case of *Prospaltella berlesei*, which is now used with marked success against *Aulacaspis* (*Diaspis*) *pentagona.*

BRÈTHES (J.). **Consideraciones sobre el Parasitismo en el Bicho de Cesto** (*Oeceticus platensis*, **Berg.**). [A Consideration of the Parasitism of the Bagworm, *Oeceticus platensis*, Berg.]—*Anales Soc. Rural Argentina, Buenos Aires*, li, no. 4, June 1917, pp. 339–340. [Received 12th September 1917.]

From the examination of a collection of bagworms in the vicinity of Buenos Aires it is concluded that 80 per cent. of *Oeceticus platensis* occurring in Argentina fail to reach maturity owing to being parasitised by various enemies. These include the Ichneumonids, *Pimpla tomyris*, Schr., *P. oeceticola*, Brèthes, *P. holmbergi*, Brèthes, *Allocota bruchi*, Brèthes, *Phobetes bruchi*, Brèthes, and the Chalcidids, *Spilochalcis bergi*, Kirby, and *Tetrastichus platensis*, Brèthes. All these have been collected in the vicinity of Buenos Aires, while the fly, *Phorocera xanthura*, was obtained from Mendoza. It is suggested that the remaining number of bagworms that are able to complete a normal development might be controlled by the introduction of further parasites from other parts. In Cordoba, for example, bagworms are not sufficiently numerous to constitute a pest, the probability being that they are held in check by their insect parasites, which, however, are distinct from those occurring in Buenos Aires, none of those found in the one region apparently occurring in the other. *Perissocentrus caridei*, a new species from this locality, can for example be easily distinguished from *P. argentinae*, Crawf. Further parasites from this

source are being studied and classified and the results will be published later; it is probable that several new species will be found among them, and it is hoped that the introduction of some of these may be of considerable assistance in checking the number of bagworms in Argentina.

WELLINGTON (J. W.). **Culture of the Globe Artichoke.**—*New York Agric. Expt. Sta., Geneva,* Bull. no. 435, May 1917, pp. 311–319. [Received 15th September 1917.]

The only insect pest attacking the globe artichoke is a black Aphid, which at times completely covers the under-sides of the leaves, especially during midsummer. It may be controlled by spraying thoroughly with a solution of 1 oz. of Black-leaf 40 and 4 oz. of whale-oil soap in $8\frac{1}{3}$ U.S. gals. of water. It is necessary to spray both the lower surfaces of the leaves and the crown of the plant.

DOANE (R. W.). **Notes on Mites attacking Orchards and Field Crops in Utah.**—*Science, Lancaster, Pa.,* xlvi, no. 1182, 24th August 1917, p. 192.

The most important mite attacking grain in Utah during 1915 and 1916 was *Tetranychus telarius,* L. (*bimaculatus,* Harv.). It has many host-plants and in 1916 was so abundant that it defoliated cherry trees and seriously attacked apricot, pear, plum and apple trees, raspberry and currant bushes, peas, beans, tomatoes, and sugar beets, as well as many ornamental plants. Maize suffered severely, the suckers and lower leaves being first attacked; while the heads of wheat, if they developed at all, were small and poorly filled. Earlier in the season wheat was attacked by two other species of mites, the clover mite, *Bryobia pratensis,* and *Tetranychus longipes,* the jumping mite. Both these mites were destructive to barley, oats and many wild grasses.

MOZNETTE (G. F.). **The Cyclamen Mite.** — *Jl. Agric. Research, Washington, D.C.,* x, no. 8, 20th August 1917, pp. 373–390, 2 plates, 6 figs.

Tarsonemus pallidus, Banks (cyclamen mite), which has been an unimportant pest of cyclamen for some years in various States of North America, has during recent years been increasing to a serious extent and during 1916 caused a severe infestation in Oregon. It seems probable that many of the diseases to which hothouse plants are subject are due to various species of *Tarsonemus,* such as *T. floricolus,* C. & F., on the leaves of a large variety of plants; *T. spirifex,* March., on oats; *T. chironiae,* Warb., on ferns, and *T. tepidariorum,* Warb., on *Chironia exigera,* in England; *T. ananas,* Tryon, causing a disease of pineapples in Queensland; *T. culmicolus,* Reut., on grasses in Russia; and *T. waitei,* Banks, destroying the terminal buds of peaches.

T. pallidus has so far been confined to a few host-plants; while showing a preference for cyclamen, it is found also on chrysanthemum and on *Antirrhinum* spp. (snapdragon). The young, tender leaves of cyclamen are attacked and frequently curled into the appearance of

a gall ; both leaf and flower-buds are infested, the mites being found in all stages within the flowers, which they discolour and cause to die prematurely. The various stages in the life-history of the mite are described and illustrated. The eggs are laid in masses in moist, dark places provided by the curling and distortion of the leaves, the average duration of the egg-stage being 11 days. The larvae are active for about 7 days, after which they enter on a quiescent stage for 3 or 4 days. All stages of the insect may be found on the plants from November until late spring and probably the adults occur in greenhouses throughout the year, though it is impossible to determine the number of generations a year owing to the broods overlapping. During autumn and winter, when the greatest damage occurs, the females are more numerous than males.

As the mites possess an extremely primitive respiratory system, it is difficult to control them satisfactorily by fumigation with various gases. When older cyclamen plants become badly infested, it is almost impossible to save them, and they should be burnt and the soil sterilised. A much better plan is to carry out preventive measures while the plants are young. Black-leaf 40 has been used successfully and safely on cyclamen, chrysanthemum and snapdragon plants, at the rate of 1 : 1,000 with the addition of a small quantity of soap. This should be first applied when the plants are transplanted, having grown about 1 to 1½ in. high, and the treatment should be repeated at ten-day intervals until the flower-buds begin to show colour [see this *Review*, Ser. A, v, p. 264]. Older plants may be dipped in an oil emulsion called Yel-ros, which contains a good deal of xylol, but this is too severe for young plants and results in scorching. The mites usually attack cyclamen first in dry weather, and poor cultivation, insufficient ventilation and moisture encourage their attack.

Isley (D.). **Control of the Grape-Berry Moth in the Erie-Chautauqua Grape Belt.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 550, 9th August 1917, 42 pp., 6 plates.

The greater part of the subject matter of this bulletin on *Polychrosis viteana* has already been noticed [see this *Review*, Ser. A, i, pp. 112–114, and iv, p. 190]. In discussing the usual measures for reducing infestation, stress is laid on the choice of a suitable adhesive in spraying. Experiment has shown resin fish-oil soap to be the best. but failing this, any yellow resin soap can be used, though not white laundry soap without resin, as it lacks adhesive qualities. The most satisfactory spraying mixture has been found to consist of arsenate of lead paste, 3 lb., or powder, 1½ lb., resin fish-oil soap, 1 lb., Bordeaux mixture containing copper sulphate, 3 lb. and lime, 3 lb., and water, 50 U.S. gals. This is best applied by " trailers," and should be used twice, immediately after the falling of the grape blossoms, and again, two or three weeks later, when the grape berries are just touching. The use of Bordeaux mixture is recommended to prevent the scorching of the foliage by the combination of lead arsenate and soap, as well as on account of its fungicidal action. Spraying operations are greatly facilitated by training the vines so that the clusters can be quickly reached and covered with spray, for unless this is done, the work is of little value.

Lees (A. H.). **Some Aspects of Spraying against Pests.**—*Jl. R. Hortic. Soc., London*, xlii, no. 2–3, September 1917, pp. 213–228.

The bulk of the matter in this paper has already been noticed [see this *Review*, Ser. A, iii, p. 286, v, pp. 173, 360, 362]. The physical means of controlling the chief pests, which occur in the egg-stage on fruit trees, by the application of hot water, has been found impracticable in the English climate under outdoor conditions, as forcing the water through a fine nozzle reduces its temperature to a point below that at which it coagulates the egg-contents. Chemical treatment with penetrative oily bodies, such as nitrobenzine or paraffin, has also proved a failure, as it damages the buds when the substance is used of a strength sufficient to kill the eggs. Experiments made with commercial bleaching powder, which is an impure hypochlorite of calcium, showed that eggs were unaffected by the strongest solutions, but when caustic soda was present as well they were attacked in a time varying from 10 to 40 minutes. The difficulty of keeping them moist with a spray fluid for so long was overcome by using a lime wash as a base, the eggs being found dead and shrunken on its removal. It was proved that bleaching powder and lime or caustic soda and lime have no lethal effects, all three substances requiring to be present together to obtain success. The eggs of moths were found to be most easily destroyed, then those of apple-suckers [*Psylla*], and Aphids; those of red-spiders seemed to be quite unaffected. The action appears to be, first the partial dissolution of the chitin of the egg-shell by the hypochlorite, followed by the penetration of the alkali to the egg-contents, causing coagulation of the albumen.

Adams (J. J.). **Disease and Insect Pests.**—*Ann. Rept. 1915–1916 Dept. Agric. British East Africa, Nairobi,* June 1916, pp. 44–47. [Received 20th September 1917.]

Young lemon trees in the stock nursery were affected by citrus psylla [*Trioza*], which was however kept in check by the use of Cooper's V2 fluid. A one-year-old Tahiti lime tree that was covered with scale-insects was painted all over with lime-sulphur wash—40 to 1 mixture—only one application being necessary to free the tree of this pest. A small yellow beetle appeared in large numbers at the beginning of the rainy season doing great damage to all plants and trees. The action of rain rendered spraying with arsenate of lead and Paris green ineffective, lime-sulphur proving only slightly more adherent, while small fires of weeds and rubbish emitting dense volumes of smoke cleared the trees but did little harm to the beetles. Plums and peaches were sprayed for fruit-flies with lead arsenate, once just after the fruits were formed, and again when half-grown, with satisfactory results. Some trees in various districts were very badly infested with the citrus red scale, *Chrysomphalus* (*Aspidiotus*) *aurantii*, which is most difficult to control, and planters should purchase trees only from nurseries that have passed the Government Entomologist's inspection. The only remedies are the painting of the whole tree, if young, with resin wash, or, in the case of large trees, fumigating with hydrocyanic acid gas.

MILLER (Z.). **Амбарные вредители и борьба съ ними.** [Pests of Stored Grain and their Control.] — **«Южное Хозяйство.»** [*Southern Husbandry*], *Ekaterinoslav*, no. 7, 13th May 1917, pp. 175–179. [Received 15th September 1917.]

A short account with the usual remedies is given of the following pests of grain and stored flour :—*Tenebrio molitor*, L., *Tribolium confusum*, Duv., *Silvanus surinamensis*, L., *Laemophloeus* (*Cucujus*) *testaceus*, F., *Sitotroga cerealella*, Oliv., and *Tinea granella*, L.

Отчетъ о дѣятельности Тифлисо-Эривано-Карскаго Земскаго Бюро борьбы съ вредителями сельскаго хозяйства за 1916 годъ. [Report on the Work of the Tiflis-Erivan-Kars Bureau for the Control of Pests of Agriculture in 1916], *Tiflis*, 1917, 36 pp. [Received 12th September 1917.]

For the first year of its existence the expenses of the Bureau amounted to over £2,600, about half of which was spent on salaries and travelling expenses for the staff. The estimate for the current year, which has been approved, amounts to nearly £5,000, including about £1,700 for the conduct of investigations and experiments and for the publication of propaganda and other literature. It is intended to pay special attention to the woolly aphis [*Eriosoma lanigerum*], as its life-history in Transcaucasia has not been studied.

UVAROV (B. P.). **Яблонная моль и плодовая моль.** [The Apple and Fruit Ermine Moths.]— **« Общедоступныя сообщенія о вредителяхъ и болѣзняхъ культурныхъ растеній.»** [*Popular Information of Pests and Diseases of Cultivated Plants*], no. 4, *Tiflis, January* 1917, 7 pp., 5 figs.

This is a popular account of the life-history and control of the apple and fruit ermine moths [*Hyponomeuta*]. The best remedy is spraying with Paris green, a mixture of the latter with Bordeaux being effective both against the moths and various fungi.

VINOKUROV (G.). **Долгоносикъ—цвѣтоѣдъ.** [*Anthonomus pomorum*, L.] — **« Общедоступныя сообщенія о вредителяхъ и болѣзняхъ культурныхъ растеній.»** [*Popular Information on Pests and Diseases of Cultivated Plants*], no. 5, *Tiflis*, April 1917, 7 pp., 5 figs. [Received 12th September 1917.]

This booklet gives a popular account of the life-history and control of *Anthonomus pomorum*.

Извлеченіе изъ протоколовъ общихъ собраній Русскаго Энтомологическаго Общества за 1916 годъ. [Extract from the Minutes of Proceedings of the General Meetings of the Russian Entomological Society for 1916.]— **« Русское Энтомологическое Обозрѣніе.»** [*Revue Russe d'Entomologie*], *Petrograd*, xvi, no. 3–4, 14th May 1917, pp. 89–111. [Received 12th September 1917.]

At a meeting of the Russian Entomological Society held on the 24th January 1916, Professor I. K. Tarnani reported on a new Tachinid parasite of *Polyphylla fullo*, L., which oviposits on the surface of the abdomen of the host.

At the meeting of the Society held on 8th November 1916, Professor M. N. Rimsky-Korsakov read a paper on Russian aquatic Hymenoptera. The species dealt with included: the Braconid, *Ademon mutuator*, Nees, which was reared from *Hydrellia* sp.; *Caraphractus cinctus*, Walker, previously recorded as *Anaphes cinctus*, Hal. [see this *Review*, Ser. A, v, p. 297]; *Prestwichia solitaria*, Ruschka, from eggs of *Lestes*, *Aeschna* and other dragon-flies, as well as from those of DYTISCIDAE; *Prestwichia aquatica*, Lubb., the females of which oviposited in the laboratory in eggs of DYTISCIDAE, in which they were able to breed, although these already contained mature larvae of *Caraphractus cinctus*; and the Eulophid, *Mestocharis* sp., reared from eggs of *Dytiscus*.

RIMSKY-KORSAKOV (M.). **Біологическія наблюденія надъ водными перепончатокрылыми.** [Biological Observations on aquatic Hymenoptera.]—**« Русское Энтомологическое Обозрѣніе.»** [*Revue Russe d'Entomologie*], *Petrograd*, xvi, no. 3–4, 14th May 1917, pp. 209–225. [Received 12th September 1917.]

Much of the information in this paper has been given in a previous article [see this *Review*, Ser. A, v, p. 297]. Some account is given of the Braconid, *Chaenusa conjungens*, Nees, bred by the author from the puparia of a species of *Hydrellia*, probably *H. mutata*, Zett., of which not less than 20 per cent. were thus parasitised.

BERGER (V. M.). **Коротды Южно-Уссурійскаго Края.** [The Scolytids of the South-Ussurian Province.]—**« Русское Энтомологическое Обозрѣніе.»** [*Revue Russe d'Entomologie*], *Petrograd*, xvi, no. 3–4, 14th May 1917, pp. 226–248. [Received 12th September 1917.]

This is a first instalment of the materials collected by the author in the northern environs of Vladivostok.

The species described are :—*Cryphalus scopiger*, sp. n., very common in Ussuria in dying branches of *Juglans mandshurica*; *C. redikorzevi*, sp. n., in *Abies holophylla*; *C. carpini*, sp. n., mining the bast of *Carpinus cordata*; *Ernoporus* (*Procryphalus*) *fraxini*, sp. n., in small branches of *Fraxinus mandshurica*, the entrance-burrow leading to a chamber from which several brood-galleries radiate; *Enoporicus spessivtzevi*, gen. et sp. n., very similar to the Mexican *Ernoporides jalappae*, Letzn., and found in company with the previous species; *Ernoporus tiliae*, Panz., in *Tilia amurensis*; and *Glyptoderes* (*Trypophloeus*) *granulatus*, Ratz., in *Populus tremula*.

Hylesinus cholodkovskyi, sp. n., lives under the bark of old ash trees (*Fraxinus mandshurica*). In both cases when this beetle was found, its mines were of a peculiar type; the adults bore short, transverse brood-galleries and oviposit on both sides of the gallery in egg-cells prepared by them; the larvae bore long wave-like mines, but always in the direction opposite to the movement of the hands of a clock; the larvae that began to bore in the other direction perished. Pupation takes place in the centre of the bark.

Pylnov (E.). **Къ познанію фауны Acridoidea и Locustoidea Сѣверной Монголіи.** [Contribution to the Acridiid and Locustid fauna of Northern Mongolia.]—**« Русское Энтомологическое Обозрѣніе.»** [*Revue Russe d'Entomologie*], *Petrograd*, xvi, no. 3–4, 14th May 1917, pp. 275–284. [Received 12th September 1917.]

This paper gives a systematic description of 34 species of Orthoptera collected in the summer of 1915 in Northern Mongolia. Of these, 13 species are new to Mongolia, while one, *Platycleis homini*, is new to science. A key for the identification of the males of the genus *Chrysochraon* is included.

Iljin (B. S.). **Наблюденія надъ** *Parandra caspia*, **Men. (Coleoptera, Cerambycidae; Описаніе ея личинки и куколки.** [Observations on *Parandra caspia*, Men. (Coleoptera, Cerambycidae); Description of its Larva and Pupa.]—**« Русское Энтомологическое Обозрѣніе.»** [*Revue Russe d'Entomologie*], *Petrograd*, xvi, no. 3–4, 14th May 1917, pp. 285–298. [Received 12th September 1917.]

The Longicorn, *Parandra caspia*, Men., is very common on the southern coast of the Caspian Sea, where it breeds in practically all the local trees except figs (*Ficus*), though the larvae and pupae are chiefly found in willow (*Salix*), poplars (*Populus*), alders (*Alnus glutinosa*), and honey locust (*Gleditschia triacanthos*).

A description of the larva and pupa is given, with some observations on the life-history. The larval stage extends over three years, while the pupal one lasts two or three weeks; the beetles remain inactive till the fat-bodies are exhausted, when they are able to fly; they bore mines which usually end in the first cavity they meet on their way, frequently those caused by larvae of *Cossus* or *Zeuzera*; in rare instances the mines lead outside the tree.

Gornostaiev (F.). **Матеріалы къ познанію фауны короѣдовъ Петроградской губерніи.** [Contribution to the Scolytid Fauna (Coleoptera) of the Govt. of Petrograd.]—**« Русское Энтомологическое Обозрѣніе.»** [*Revue Russe d'Entomologie*], *Petrograd*, xvi, no. 3–4, 14th May 1917, pp. 308–315. [Received 12th September 1917.]

This is a list of Scolytids observed by the author during 1915–1916 in the environs of Petrograd.

Scolytus (*Eccoptogaster*) *ratzeburgi*, Jan., has of late years seriously infested birch trees, large numbers having perished. *S.* (*E.*) *rugulosus*, Ratz., though nearly absent in the locality ten years ago, is now present in large numbers on sorb, bird-cherry and medlar trees. *Phloeophthorus* (*Phthorophloeus*) *spinulosus*, Rey, is very common in the lower, dying branches of old spruce trees; adult beetles were frequently found in winter in pairs in the brood-galleries, the larval mines from the latter containing larvae of various ages, pupae and also young beetles. The adults were frequently observed to oviposit after hibernation in the brood-galleries. *Hylesinus crenatus*, F., has been present for some years in old ash trees. *H. fraxini*, Panz., was very rare a few years ago, but now is common in ash trees. *Myelophilus piniperda*, L., and *M. minor*, Hart., infest pines, and very rarely spruces, and are regarded as the most dangerous enemies of pines.

Dendroctonus micans, Kug., was found in old spruce trees; *Xylechinus pilosus*, Ratz., in dead and dying spruces and also in silver firs and larches; *Polygraphus polygraphus*, L., in spruces; *P. subopacus*, Thoms., in spruces, less frequently in pines; *Crypturgus pusillus*, Gyll., and *C. cinereus*, Hbst., underneath the bark of spruces and pines; *Hylurgops glabratus*, Zett., and *H. palliatus*, Gyll., in spruces and pines; *Hylastes ater*, Payk., in pines; *H. cunicularius*, Er., in spruces; *H. opacus*, Er., in pines; *Ips sexdentatus*, Börn., underneath the bark of old pines, less frequently in spruces; *Ips typographus*, L., in spruces, there being probably two generations.

Ips duplicatus, Sahlb., which is very rare in Western Europe, is widespread in Russia, in the spruce woods; its life-history differs somewhat from that of the previous species. Young beetles, having emerged after hibernation, were observed to attack spruce, under the bark of which they gnawed mines. They did not oviposit in these and were evidently only feeding; in the first half of June they began to mine in spruces other than those previously attacked, and by the middle of July young beetles were already present underneath the bark. *Ips acuminatus*, Gyll., after the two species of *Myelophilus*, is the most common Scolytid found in pines; the beetles are on the wing in the first half of June. The young beetles appear underneath the bark in the second half of summer, gnawing at the larval mines. In August these beetles pass to other trees, in which they mine and hibernate.

Neotomicus proximus, Eichh., *N. laricis*, F., and *N. suturalis*, Gyll., were found in large numbers in fallen pines; in rare cases the first and last were also present in spruces. *Pityogenes chalcographus*, L., is very common in both spruces and pines. *P. quadridens*, Hart., and *P. bidentatus*, Hbst., occur in pines, and *Pityophthorus micrographus*, Eichh., in spruces. One example of *P. lichtensteini*, Ratz., was found in a pine branch in which it oviposited. *Dryocoetes autographus*, Ratz., occurs in spruces and *D. alni*, Georg., although previously rare, has recently become very common in alders (*Alnus incana*, L.); the beetles avoid boring in very young and juicy bark. This species is gregarious, many beetles using the entrance-mines bored by other individuals; beneath the bark a common rosette is formed, from which the brood-galleries, sometimes over twenty in number, radiate in all directions. The brood-galleries are made by both sexes at different stages of maturity; each mature female continues the boring, laying eggs in the cells, while the young beetles gnaw the walls of the mine and frequently penetrate into mines other than their own. At the end of the summer all the mines become much entangled. Oviposition begins only a month after the beetles have emerged, this time being occupied in feeding. *Cryphalus saltuarius*, Weise, attacks young diseased or weak spruce trees, and *C. abietis*, Ratz., and *Ernoporus tiliae*, Panz., lime trees. *Trypophloeus alni*, Lind., was first found in alders in 1914. *Xyloterus signatus*, F., is very common in alders and pines. *X. lineatus*, Oliv., is frequently found in spruce and pine; in April it attacks spruces damaged by wind in company with *Hylastes palliatus*. *Xyleborus* (*Anisandrus*) *dispar*, F., attacks alders and *X. cryptographus*, Ratz., poplar trees.

Bieloussov (V.). **Короѣды сѣверныхъ Саянъ.** [The Scolytids of the North Sayansk Mountains.] — **« Русское Энтомологическое Обозрѣніе.»** [*Revue Russe d'Entomologie*], *Petrograd*, xvi, no. 3–4, 14th May 1917, pp. 334–337. [Received 12th September 1917.]

The following list is given of the Scolytids collected by the author in 1915 in the Northern Sayansk Mountains (Province of Yenissei, Siberia).

In *Betula verrucosa* : *Scolytus* (*Eccoptogaster*) *ratzeburgi* and *Xyloterus signatus.* In *Larix sibirica* : *Ips laricis* and *Xyloterus lineatus.* In *Pinus silvestris* : *Ips sexdentatus, I. typographus, I. laricis, I. suturalis, I. subelongatus* and *Dryocoetes autographus.* In *Pinus cembra* : *Hylastes glabratus, Pityogenes bistridentatus, P. chalcographus, Ips sexdentatus, I. laricis, Pityophthorus micrographus* and *Xyloterus lineatus.* In *Abies sibirica* (Siberian silver fir) : *Carphoborus rossicus, Xylechinus pilosus, Hylastes glabratus* and *Xyloterus lineatus.* In *Picea obovata* (Siberian spruce) : *Carphoborus rossicus, Xylechinus pilosus, Polygraphus subopacus, Hylastes glabratus, H. palliatus, Pityogenes bistridentatus, P. chalcographus, Ips typographus, I. laricis, I. subelongatus, Pityophthorus micrographus, Dryocoetes autographus* and *Xyloterus lineatus.*

As may be seen from this list, the Siberian silver fir, although the most widespread tree in Sayansk, has no species of bark-eaters peculiar to it, owing principally to the amount of pitch in the bark and wood ; it is however attacked by the beetles common to the Siberian spruce, both trees usually growing in the same places.

Tuason (D. R.). **A Study of Cucurbitaceous Vegetables in the Philippines.** — *Philippine Agriculturist & Forester, Los Baños*, v, no. 10, February 1917, pp. 315–342, 6 plates.

Cucurbitaceous plants in all stages of their growth are very susceptible to the attack of insects, those doing most damage including a small black ant that enters the seed and devours the contents as soon as the embryo ruptures the seed-coats. Powdered naphthaline on the surface of the soil acts as a preventive, or the seeds may be protected by growing them in flats or seed-boxes placed on a table, the legs of which are placed in small cans filled with water. Cutworms attack the stems of old and young plants, especially newly-transplanted ones, while the yellow beetle, *Aulacophora coffeae*, Hornst., eats the soft parts of the leaves, leaving only the skeleton. An effective remedy is ashes, or Paris green, mixed with lime in the proportion of one part Paris green to thirty parts of lime by weight, applied as soon as new leaves are formed. The squash-vine borer [*Melittia satyriniformis*] attacks the plants without showing external injury and is best dealt with by trap-plantings, which are afterwards burned or ploughed under, deep enough to kill the larvae and destroy the eggs at the same time. Plants may be rendered more vigorous and better able to resist this pest by the formation of adventitious roots at their joints, induced by hilling. Melon lice [*Aphis gossypii*] attack the leaves, and a control measure must be employed as early as possible, the best being the application of kerosene emulsion. This is made by dissolving half a pound of soap by heating it in one U.S. gallon of water in a tin vessel, and, while still hot, two U.S. gallons of kerosene are added, little by little

till both liquids are thoroughly mixed. For use, it should be diluted with water in the proportion of one part to thirty. Fumigation with burning tobacco stems and other agents, after placing a low tent over the plants, has been tried with only partial success. The bug, *Leptoglossus membranaceus*, F., combines with the melon fly to destroy the fruit, the flies laying their eggs in the holes made by the bug. The melon fly, *Dacus cucurbitae*, Coq., attacks the fruits only, ovipositing in wounds on the surface. The feeding of the larvae on the internal soft parts results in complete rotting.

PETHERBRIDGE (F. R.). **Frit Fly (*Oscinis frit*) attacking Winter Wheat.**—*Ann. App. Biol., London*, iv, nos. 1 & 2, September 1917, pp. 1–3.

It is evident from the records of the past three years that *Oscinella* (*Oscinis*) *frit*, which is known to injure late-sown spring oats, must also be considered a pest of winter wheat in Britain, the attacks generally occurring on crops that follow rye grass or Italian rye grass (*Lolium italicum*), though many species of grasses are recorded as food-plants of this fly. Wheat sown in mid-November and early December has been found infested, which is unexpected, if the fly has but three generations in a year, as previously supposed. The first brood has been known to appear in April and May and deposits eggs on spring corn; the second appears in July, eggs being laid on the ears of oats or barley or on the shoots of cereals and grasses; the third is found in August and September and oviposits on shoots of grasses or early-sown winter corn. Without further knowledge of the life-history, it is difficult to account for the attacks on winter wheat, but the following hypotheses are suggested: The third brood of flies may hatch over a very long period, so that the last ones oviposit on winter wheat; some of the third brood may be capable of living until December before laying their eggs; the larvae of the third brood may under certain conditions give rise to a fourth brood that oviposits on winter wheat; finally, the flies of the third brood may migrate from the plants on which they have hatched to the wheat, which is sown after the former host-plants are ploughed in. This last seems the most probable explanation and would also account for the absence of the adult fly in the winter months. Further knowledge as to the life-history of *O. frit* is needed before the most efficient means of reducing attacks on winter wheat can be discovered.

WALTON (C. L.). **Some Farm Insects observed in the Aberystwyth Area, 1913-1916.**—*Ann. App. Biol., London*, iv, nos. 1 & 2, September 1917, pp. 4–14.

The caterpillars of *Pieris brassicae* and *P. rapae* damaged garden Crucifers and to a lesser extent swedes, from sea-level to 1,100 ft. altitude. Broccoli and sprouts growing on steep, sunny banks and in the upper parts of fields in hot, dry places, suffered most, while gardens and fields in damp situations were least affected. Scattering lime and soot and dusting with basic slag and baking-powder were found unsuccessful, though dusting with pyrethrum was rapidly effective. A large proportion of the larvae were parasitised by the Braconid, *Apanteles* (*Microgaster*) *glomeratus*.

Two species of flea-beetles, *Phyllotreta* (*Haltica*) *nemorum* and *Haltica oleracea*, occurred, the former predominating in some localities. Dry weather and sunshine encourage their increase, the damage being most severe on young root crops on dry slopes. Mangels, swedes and turnips were successively attacked. The common weed, *Polygonum persicaria*, was much infested by the beetles. Farms on which lime and basic slag are regularly used are comparatively free from infestation. Soaking seed in paraffin has proved beneficial. *Anthonomus pomorum*, L. (apple weevil) and *Apion apricans*, Hbst. (clover weevil) were found upon apple blossom and hay crops respectively.

Agriotes sp. (wireworms) injured oats and swedes, and, less severely, wheat and potatoes. Farmers who used basic slag freely, or kainit or a similar substance, seldom complained of attack; most of the damage was done to second successive crops of oats. A dressing of soot, harrowed in and subsequently rolled, gave excellent results. *Phyllopertha horticola*, L. (garden chafer) is exceedingly abundant at times on dry, sunny slopes, but is largely controlled by rooks.

Many Aphids are recorded, a list of these being given with their host-plants. Those of economic importance include *Rhopalosiphum ribis*, which however is seldom found in appreciable numbers; *Aphis rumicis* was abundant on broad beans in 1915 and upon mangels, but in the following year the infestation was slight on both plants; *Macrosiphum granarium* occurred on black oats, but not to any serious extent; *Eriosoma* (*Schizoneura*) *lanigerum* is found practically wherever apples are grown, but generally in small numbers. Scale-insects were not common in the area surveyed, with the exception of *Chionaspis salicis*, L., which is abundant on ash, birch and various species of *Salix*. *Lepidosaphes ulmi* was found on apple and pear, but is seldom of any importance. *Eulecanium* (*Lecanium*) *persicae*, F., and *E.* (*L.*) *capreae*, L., occurred in private gardens. A list is given of nine species found on indoor and greenhouse plants.

Cecidomyids included *Perrisia crataegi*, Winn., which injures the tips of young hawthorn shoots, and *Rhabdophaga salicis*, Schr., which forms galls on *Salix*. Tipulids included *Tipula oleracea*, L., *T. lateralis*, Meig., and *Pedicia rivosa*, L., in pasture lands. *Hylemyia antiqua*, Mg. (*Phorbia cepetorum*, Bch.) (onion fly) was observed on leeks; mangels were found blistered, apparently by *Pegomyia hyoscyami* (mangel fly), though the adult flies were not observed. Minor pests included *Lipura ambulans*, L., on leeks and French beans, *Sminthurus luteus*, Lubb., on field mushrooms, several species of ants, wasps and bumble bees. *Apis mellifica* (honey bee) has suffered severely from Isle of Wight disease near Aberystwyth, though country hives are as yet free from the disease. *Pteronus* (*Nematus*) *ribesii*, Scop. (gooseberry sawfly) attacked gooseberries and red currants. Mites included *Eriophyes ribis*, Nal., *E. avellanae*, Amerl., on hazels, and *Tyroglyphus longior*, found destroying an oat rick.

Eales (N. B.). **The Life-History and Economy of the Cheese Mites.**—*Ann. App. Biol., London*, iv, nos. 1 & 2, September 1917, pp. 28–35.

The losses due to the depredations of cheese mites are considerable. Four species attack cheese: *Carpoglyphus anonymus* infesting Cheddar, and *Tyroglyphus siro*, *T. longior* and *Aleurobius farinae* attacking both

Stilton and Cheddar. These mites thrive equally well in flour, stored grain, dried fruits, drugs, hay, etc., when these are allowed to become damp. The life-histories of all these species are similar, occupying about four or five weeks. The eggs hatch in about 10–12 days after being laid; the larva feeds actively for about a week, then becomes quiescent and moults, emerging as the first nymph. Three successive moults occur before the adult appears. *T. longior* has an additional stage after the first nymph stage; in this form, known as the hypopus stage, it attaches itself to other mites, flies or moths, and sometimes to the skin and clothes of human beings. It is thus carried about until it finds a suitable place, where it drops off, moults to the second nymphal stage and commences feeding. Investigations have been made into the manner of infestation of new cheeses. Stiltons are usually made from April to September and are cleared out of the dairies by December. From December to April the Stilton room is generally empty or is used for other cheeses that are not attacked by mites. Scrapings from corners, window-ledges and shelves of such rooms invariably revealed a few living mites among the dead individuals and dust, even in dairies where the greatest precautions are taken. Only adult forms were found, indicating that the mites pass the interval between the Stilton periods in that stage. Experiments to determine the method of dispersal from cheese to cheese and from shelf to shelf showed that flies and moths can carry the mites, and this seems to be the most probable method of dissemination, though other possibilities are that the mites could be blown by a draught across the small space intervening or that the person who turned the cheeses regularly may have carried them in spite of every care and attention. Although these pests have no eyes, they can distinguish between light and darkness and prefer the latter. For this reason attacks by mites are worse in a dark room, and the practice of having cheese rooms partly or entirely underground, while necessary in order to maintain an even temperature, is favourable to the mites.

It is extremely difficult to kill the adult mites and almost impossible to kill the eggs. Soap and boiling water will not kill them on the shelves, as they hide in cracks and crevices in the wood. Some cheese-makers dip their cheeses in formalin, but mites kept in 5 per cent. formalin for over a week were alive at the end of that time. The only two substances that were found to kill the mites within a short time were carbolic acid and carbon bisulphide. The former, being poisonous, cannot be used on the cheeses themselves, but might be used for scrubbing the shelves, at 5 per cent. strength. The vapour of carbon bisulphide kills the mites almost instantaneously. The best method of application proved to be covering the cheese with a bell jar, the bisulphide being allowed to evaporate in a small vessel at the top of the jar. Even then a few mites still survive underneath the cheese. The most effectual method was to paint the whole surface of the cheese with carbon bisulphide, but this is a slow process and is costly. The cheese must be treated three times; once to kill the adults, again when the eggs have hatched to kill the larvae, and a third time to ensure that all are destroyed. Further experiments with these methods will be carried out. Preventive measures are naturally better than cure, and an attempt will be made in a dairy to employ such thorough methods of cleansing that no mites can survive.

As flies and moths are known to be carriers of the mites, a natural recommendation is the screening of all doors and windows in the cheese rooms; this precaution would also eliminate "skippers" from the cheeses by preventing the ingress of cheese flies [*Piophila casei*]. Injury is considerably lessened by brushing the cheeses daily to remove the dust formed by the mites.

WELSFORD (E. J.). **Investigation of Bulb Rot of Narcissus.**—*Ann. App. Biol., London,* iv, nos. 1 & 2, September 1917, pp. 36–46, 5 figs.

Investigation into the cause of the disease known as bulb rot of narcissus disclosed the fact that diseased bulbs were infested with various pests, the chief being the mite, *Rhizoglyphus echinopus*, the Syrphids, *Eumerus strigatus* and *Merodon equestris*, and the Nematode, *Tylenchus devastatrix*. The larvae of *E. strigatus* and *M. equestris* were found to do considerable harm to narcissus plants, but the damage done was quite distinct from the symptoms of bulb rot. *R. echinopus* is common on unhealthy bulbs, but in no case was bulb rot obtained by deliberate infestation with the mite. In all the diseased bulbs dissected in the course of this investigation, the eelworm, *T. devastatrix*, or its eggs, have been found. Fifty healthy bulbs infected artificially with the eelworm and placed in sterilised soil developed the symptoms of bulb rot without any *Fusarium* appearing. Various experiments on these lines all led to the conclusion that *T. devastatrix* is the sole cause of the disease [see also this *Review*, Ser. A, v, p. 441]. Diseases in hyacinths and onions have also been ascribed to this and other eelworms.

While the bulbs are in the ground, there is very little fear that the eelworms will migrate to neighbouring weeds. As soon as the bulbs are lifted, however, any eelworms remaining in the ground are likely to migrate to suitable weeds, which would thus become valuable traps. The question of migration and its extent would be well worth investigation. A list of the more common British weeds and cultivated plants that have been described as affording shelter to *T. devastatrix* is given. Precautionary measures that will check its ravages to some extent include care in selecting ground that has not been previously infected with *T. devastatrix*, and, more particularly, has not borne a crop of infested narcissus. It should be remembered in planting that one diseased bulb will soon infect many others. Bulbs that do not produce foliage at the proper time or that produce curved or crinkly leaves should be dug up and burnt before they rot and liberate eelworms in the soil. Dying leaves should be gathered and burnt before they can fall on the soil and possibly infect it. Before replanting the ground, all weeds should be removed and burnt; they should never be allowed to wilt on the soil nor be dug in. This is especially the case with weeds growing in infested soil.

GRAY (R. A. H.). **Notes on a Plague of Psocids in a Factory.**—*Ann. App. Biol., London,* iv, nos. 1 & 2, September 1917, pp. 47–49.

Psocids, which feed as a rule on minute fungi and animal and vegetable refuse, are only occasionally recorded as destructive to corks, books, etc., that have been stored in damp surroundings. The

genera most frequently associated with this type of damage are *Atropos* and *Caecilius*. The present paper records an unusual infestation of *Caecilius pedicularius*, which had established itself in the straw stored in a factory where straw mattresses are made. The store-rooms were thoroughly fumigated with rock sulphur placed in an iron receptacle with hot cinders on the top. The treatment was given twice, 10 lb. of sulphur being used on the first occasion and 15 lb. on the second, each fumigation lasting 24 hours. The concrete floors were then washed with carbolic soap, the walls whitewashed with a wash containing some carbolic acid, and cracks in the floor in which some immature Psocids had been observed were cemented. This treatment proved entirely successful. In investigating the source of the outbreak it was found that straw coming in to the factory from one farm was dirty and in bad condition. This source of supply was stopped and six months later the factory was still free from any recurrence of the infestation.

GREEN (E. E.). **A List of Coccidae affecting various Genera of Plants.** *Ann. App. Biol., London*, iv, nos. 1 & 2, September 1917, pp. 75–89.

This paper, the contents of which are indicated by its title, consists of the first part of a valuable list of Coccids and their food-plants, compiled partly from existing publications and partly from the author's own collections and observations extending over a period of several years.

GREEN (E. E.). **Note on the Immunity of Chalcid Parasites to Hydrocyanic Acid Gas.**—*Ann. App. Biol., London*, iv, nos. 1 & 2, September 1917, p. 90.

When several individuals of *Lecanium* were subjected to strong fumes of hydrocyanic acid gas for a period of 18 hours for the purpose of preservation, it was found that large numbers of living Chalcids emerged from the bodies of the Coccids after their removal from the killing bottle. This fact may have an important bearing upon the treatment of scale-insects in the field, when they are known to be infested by useful parasites, as it would appear to be possible to fumigate scale-infested trees without affecting the emergence of the Chalcids.

RITCHIE (A. H.). **Pineapples. Visit of the Entomologist to Above Rocks and District.**—*Jl. Jamaica Agric. Soc., Kingston*, xxi, no. 7, July 1917, pp. 264–265.

Metamasius ritchiei, Mshl. (pineapple weevil) has destroyed a large percentage of pineapple plants and fruits, owing principally to the failure of the growers to carry out the control measures that had been recommended. These should consist of clearing out and slashing up infested fruits and plants, which, when thus treated, quickly dry up and prevent the development of the larvae contained in them. Instead of this, many infested plants have been dug up and left in the fields in heaps, thus enabling the immature stages to complete their life-cycle. Plants under poor conditions of growth are naturally the

most severely attacked. Mealy bugs were prevalent around the base of the fruits; the inter-relation of weevil and mealy bug is considered worthy of closer attention. As a preventive against weevil attack, new pineries should be established outside or remote from existing ones and the young slips for planting should be proved to be sound, without any burrow passing from parent to slip and without any jelly-like exudation. A careful watch should then be maintained; any injured plant or fruit should be forked out and chopped open, careful search being made round the leaf-bases and in the jelly for adult weevils, which should be picked out and killed. Examination should be systematic and clean culture should be practised.

Ritchie (A. H.). **Coconut Beetles.**—*Jl. Jamaica Agric. Soc., Kingston,* xxi, no. 7, July 1917, p. 269.

The Rutelid beetle, *Macraspis tetradactyla*, L., a specimen of which was taken from the heart of a coconut palm, is reported to have caused considerable damage during the year. Very little is known of the life-history and habits of this species, and these require further investigation. Adults may be killed by applications of arsenate of lead or other arsenicals to the heart of the coconut palm, and this treatment should be supplemented by an attack on the breeding places. If arsenate of lead is not procurable, $1\frac{1}{4}$ lb. calcium arsenate may be substituted in place of 2 lb. lead arsenate.

Anstead (R. D.). **Annual Report of the Deputy Director of Agriculture, Planting Districts, for the Year ending 30th June 1917.**—*Planters' Chronicle, Bangalore,* xii, no. 34, 25th August 1917, pp. 422–425.

Scale-insects were troublesome on coffee and *Coccus viridis* occurred generally, although less abundantly, than in previous years. Early rains encouraged the growth of parasitic fungi, which largely controlled the scale. Ants are now sprayed and destroyed regularly and are fairly under control. The most successful spray for scale-insects has been fish-oil resin soap as manufactured by the Madras Fisheries Department. The coffee borer [*Zeuzera coffeae*] has been less prevalent than in previous years, and appears to have definite cycles of occurrence. A tiger beetle (*Collyris*) was reported for the first time during the year as boring in coffee stems [see this *Review*, Ser. A, v, pp. 121, 164]; this pest has not yet attained any importance.

Tea was attacked by *Helopeltis*, which is particularly troublesome during the monsoon months, when spraying is impossible. Spray fluids are considered useless in the case of a bad attack; a combination of spraying at the beginning of an attack, hand-collection and cultural methods are the only successful means of control. The author emphasises the advantage of pruning large areas in time for the young foliage to develop before the attack of *Helopeltis* begins. Limacodid, *Contheyla rotunda*, was reported for the first time damaging tea, but the caterpillars were controlled by pruning and hand-picking. The butterfly, *Terias silhetana*, made a sporadic attack on *Albizzia* and the tea beneath it; this attack was easily controlled.

RICHARDS (R. M.). **The Diseases and Pests of the Coconut Palm.**—*Agric. Bull. Fed. Malay States, Kuala Lumpur*, v, no. 8–9, May-June 1917, pp. 327–337. [Received 24th September 1917.]

Oryctes rhinoceros is abundant in the Malay Peninsula. Preventive measures are most important; larvae should be collected and breeding-places destroyed. Débris of coconuts should be collected and destroyed regularly. Traps are not as a rule very successful, but on scrupulously clean estates they have proved of some benefit. *Xylotrupes gideon* (leaf beetle) should be controlled by collecting the adults. *Rhynchophorus ferrugineus* passes through all stages of its life-history on the coconut, the larval being the destructive stage [see also this *Review*, Ser. A, v, p. 499]. The adults and larvae of the Hispid, *Brontispa frogatti*, Sharp, are both destructive to coconuts. The beetles crawl into the folded leaflets and oviposit between them, the larvae and adults eating away the tissues. In the Solomon Islands tobacco and soap wash is shaken into the still unfolded leaves, but the only really successful method of eradication is to cut away the affected leaves and burn them. The larvae of *Hidari irava* and *Erionota thrax* eat away the leaflets, but both species are heavily parasitised and rarely if ever survive after the second brood. Catching the adult butterflies or picking off and destroying the pupae are generally a sufficient remedy. *Thosea cinereomarginata* is commonly found in the pupal stage attached to the under-side of palm-leaves; the caterpillars devour the young leaflets, but there is very seldom any serious infestation. A Psychid, *Mahasena* sp., occurs on coconuts, but is not a serious pest.

The Zygaenid, *Brachartona catoxantha*, is a serious pest, but after a maximum of six generations, and frequently less, parasites have multiplied to such an extent that this moth is practically exterminated; its parasites, of which the most important are a fungus, *Botrytis* sp., and a Phorid fly, then die off and three years apparently elapse before there is another serious infestation of the moth. Preventive measures adopted on one plantation, which had the desired effect, consisted of cutting off and burning all the lower leaves of palms which had been badly eaten and on which many thousands of insects were pupating. As soon as the caterpillars that hatch from eggs on the under-side of the leaves appeared, they were singed with torches, causing them either to die or drop to the ground. As they immediately try to get back by crawling along the ground and up the stems of the palms, a band of tar and grease was painted on the stems about 1½ ft. above the ground, thousands of caterpillars being caught by this means on almost every tree. They were also beaten, shaken and brushed off the leaves of the palms. Comparatively few moths developed of the next generation and within three months of this treatment the pest had disappeared. No part of the palm but the leaves should be scorched; if the crown be injured, attack by *Rhynchophorus ferrugineus* will probably follow. *Coptotermes* (*Termes*) *gestroi* occasionally causes injury by boring into the tissues of the stem. Scale-insects are chiefly troublesome in encouraging the sooty mould, *Meliola palmarum*.

RICHARDS (P. B.). **The History and Present Position of White Ant Treatment in Malaya.**—*Agric. Bull. Fed. Malay States, Kuala Lumpur*, v, no. 8–9. May-June 1917, pp. 338–348. [Received 24th September 1917.]

This paper discusses the history of combating *Coptotermes* (*Termes*) *gestroi* in Malaya. The first record of injury by termites in the Peninsula was made in 1895, when it was thought that these insects merely removed dead tissue from diseased trees, without causing any active injury. The species thus referred to was probably not *C. gestroi*, which could not at that time have attained much economic importance or its habit of attacking living trees would have been observed. Many efforts towards the prevention and cure of the attacks of *C. gestroi* were subsequently made, but without the requisite knowledge of the life-history of the species. In 1908 an important step was taken in the discovery that *C. gestroi* attacks dead as well as living wood. Trenching, digging, poisoning, fumigating, tracing the runways and numerous other measures were tried and found incapable of eradicating the pest. Fumigation was the best palliative and is still considered an efficient accessory method of control, but in 1915 the author was driven to the conclusion that the only safe preventive and remedial treatment was absolutely clean clearing. This method was tried on a plantation suffering from a particularly heavy infestation. Surface timber was destroyed, stumps were blasted and removed, while buried logs were prospected for with probes, dug out and burnt. The result was excellent, the termites that had previously caused a mortality up to 75 per cent. among 18-month-old rubber being completely eradicated. This method naturally involves considerable expenditure, which the author considers justified in view of the value of the crop. Since the mode of attack of certain fungi emanating from decaying timber upon the roots of rubber has been understood, the importance of this treatment has been emphasised, and the practice is gradually gaining ground. The same arguments for complete clearing apply to coconut cultivation, beetle-grub attacks in the rotting wood replacing fungoid diseases. The solution of the problem of the best and cheapest method of clearing land of undesired timber rests with the practical planter.

SOUTH (F. W.). **Application of the Agricultural Pests Enactment.**—*Agric. Bull. Fed. Malay States, Kuala Lumpur*, v, no. 8–9, May–June 1917, pp. 349–357. [Received 24th September 1917.]

Since the passing of the Agricultural Pests Enactment in 1913, prohibiting the introduction into the Federated Malay States of any plant or animal or other matter likely to harbour a pest [see this *Review*, Ser. A, ii, pp. 391, 479], routine work such as is required by the inspecting officers has been regularly and efficiently carried out. Coconut inspection work has resulted in a great diminution of the damage caused by the coconut beetle [*Oryctes*]. During 1915 there were a few serious beetle outbreaks in certain localities; in 1916 no serious infestations were recorded and during the present year the trees in previously infested districts have been free from beetles for over a year and have much improved in consequence. The work of

destroying locusts has steadily progressed since its commencement in 1913; a few locusts were present during 1916 and were watched carefully until the end of the year. Many districts are now practically free from locusts, so that very little more work is required there.

Pettey (F. W.). **The Quince Borer and its Control.**—*Union S. Africa Dept. Agric., Pretoria,* Bulletin no. 2, 1917, 17 pp., 9 figs. [Received 26th September 1917.]

For many years, probably as long as the quince hedge has existed in the Cape Province, this fruit has been attacked by the larva of a Cossid moth, *Coryphodema tristis*, Dru. (*capensis*, Feld.). *C. punctulata* recorded from the northern Transvaal may possibly prove to be the same species.

Though quince is the favourite food-plant, many varieties of apples and a few pears are attacked, and this moth has also been recorded in grapes, loquats and in *Buddleia madagascariensis*, which was introduced from Madagascar. *C. tristis* is apparently distributed all over the Cape Province wherever quinces or Wemmershoek apples are grown. As it is not known to occur in any other country, it is believed to be indigenous in South Africa and should therefore be found on a native plant. The damage caused by its infestation is serious, as it kills many of the branches, in which it bores, and impairs the bearing capacity of the tree. The morphology and life-history of the insect were studied from infested quince branches placed under wire-netting cages; a graph records the emergence of the moths during 1915 and 1916. The adult moth apparently has rudimentary mouth-parts and lives a maximum of six days, thus allowing only a short period for oviposition. One female may lay from 104 to 316 eggs; these are deposited in an irregular mass formed of many clusters in any rough or sheltered place in the bark of the branches and trunks of the trees, and sometimes in the openings of old burrows in the angles where one branch joins another, under the scales of the bark, and especially in the cracks of rough swellings caused by the woolly aphis [*Eriosoma lanigerum*]. A period of 63 days may elapse before the eggs hatch. The larvae upon hatching immediately begin to feed on the empty egg-shells and construct a thin layer of silk and sawdust-like particles that completely covers them. In a few days they bore their way into the bark, the accumulations of frass thus produced rendering the presence of the insect evident. They feed in this manner for at least two months, though a few individuals penetrate the woody tissue about five days after emergence from the egg. If the covering be removed during this period, the larvae escape into small holes that they have bored in the bark, being evidently sensitive to light. The area of decayed bark injured by the insects at this time, if not cut away by a knife, spreads and ultimately encircles the branch through the inability of the cambium to heal over the dead area. Finally the ring of decay cuts off the sap supply from the roots and the branch dies. After about eight weeks the larvae begin to bore into the woody tissues, where they remain active for about a year and a half before pupating. The

burrows of the individual larvae are not separated; in a small branch there is one long, continuous burrow with rather large openings at intervals, with as many or more larvae in the tunnel as there are openings. At what stage in development these openings are made is not known. The larvae are not able to subsist on dead wood; all those observed in the field were feeding upon living branches and attempts to breed them in quince branches cut from the trees were unsuccessful. The larvae begin to make their cocoons about the last week of March in their second year, all having pupated by the end of July. The pupal stage lasts about five months. A calendar is given tabulating the life-cycle of this borer, which occupies a total of 760 days. Stages of two successive generations may be found in the same orchard.

Remedial measures included experiments in inserting a wire into the burrows, but the results show that only about 80% of the insects can be killed by this method, which is often difficult to carry out and is slow in application. To be effective, it should be done during September, when the openings of the burrows are large enough for wire to be inserted and when the moths of the older generation have not yet emerged. The wire should be inserted up, as well as down, the burrow. The cutting away of the area of bark under which the larvae are feeding before they enter the wood and scatter has been found impracticable for several reasons: it would not touch the larvae that enter the wood almost immediately upon hatching; some young infestations cannot be reached owing to their position; and this method, even if successful, would have to be applied over at least two years, as there is no period when all individuals are to be found just beneath the bark.

The injection of different insecticides into the burrows has been tried with varying results, which are shown in a table. Paraffin and raw linseed oil are effective in killing active larvae, but fail to destroy the larval and pupal stages within the cocoons; arsenate of lead and soap and water and tobacco-soap solution are useless for this purpose. Paraffin oil should not be used on account of its injurious effect on the bark of the tree. One application of raw linseed oil, injected into the burrows of both old and young larvae, will kill over 90 per cent. of the insects, if applied about the middle of March, when all the eggs have hatched, when all the insects are in the active larval stage, and when the burrows of the young larvae are sufficiently large to facilitate the insertion of the syringe. The sawdust-like accumulations should first be brushed away with the hand from the openings, then the injections should be made with a small syringe of 1 or ½ pint capacity, beginning at the topmost hole. It is not necessary to insert the syringe in every hole. Two or three weeks after this treatment the trees should be inspected and, if any burrows show fresh accumulations of sawdust at their openings, these should be treated again. Attempts were made to prevent emergence of over 100 moths by plugging the openings of the burrows with soap, but this was a slow process and over 50 per cent. of the moths succeeded in emerging by pushing out the obstruction. All old and neglected quince hedges or bushes should be destroyed to prevent the spread of infestation to properly cultivated orchards.

Rodda (T. E.). **Spray-testing at Arataki. Summer Control of Woolly Aphis.**—*Jl. Agric., Wellington, N.Z.*, xv, no. 1, 20th July 1917. pp. 23–24.

As a result of spraying tests with different compounds, consisting chiefly of Black-leaf 40 in varying strengths or of resin-soda, the latter substance was found to scorch foliage more or less wherever used. The woolly aphis [*Eriosoma lanigerum*] was killed by the spray wherever it had touched it with any force, but where this had not occurred, the insects were still active. Black-leaf 40 appeared to have greater penetrating power than resin-soda, probably owing to the soft-soap added to the mixture. Resin-soda proved the cheaper mixture, but takes a considerable time to prepare.

Miller (D.). **The Makerua and Moutoa Flax Areas in Relation to Larval Attack.**—*Jl. Agric., Wellington, N.Z.*, xv, no. 1, 20th July 1917, pp. 25–29.

This paper contains notes supplementing a previous article [see this *Review*, Ser. A, v, p. 453]. The topography of the Makerua and Moutoa flax areas on the Manawatu River is described in detail. On certain areas that have been overdrained there is a good growth of New Zealand flax [*Phormium tenax*], but owing to the comparative dryness produced by draining, the conditions are exceptionally favourable for the propagation of the caterpillars. Apparently more leaf-tubes form under these conditions than where there is a moderate amount of moisture. If moisture affects the age of the leaf, the advantage of not having the swamps over-dry would be twofold ; there would be more leaf at the time of cutting and less larval attack owing to the lack of leaf-tube shelters. In moister localities fewer leaf-tubes appear and larval attacks cause no appreciable damage.

Recent investigations have shown that the larvae of the flax-grub [*Xanthorhoe praefectata*] winter in the soil, indicating the possibility that winter flooding will prove an effective method of control. The ground should be flooded just before pupation. Investigations are being made to determine the minimum saturation of soil necessary to kill the larvae. The flax-grubs first appeared as a bad infestation where flax was being milled along the river bank just after draining, in 1902. As a result, 11 tons of leaf were required to produce 1 ton of fibre, in place of the normal 8 tons. On the east side of the river the grub did not appear until eight years after draining, becoming serious in 1910 and 1911, and gradually decreasing in numbers until the present time.

Orchard-Spraying Experiments in the Stoke District.—*Jl. Agric., Wellington, N.Z.*, xv, no. 1, 20th July 1917, pp. 30–36.

This paper deals chiefly with spraying experiments against mildew and other fungus diseases. Trials showed that a dormant spray of lime-sulphur followed by the usual summer sprays was a satisfactory remedy for red mite [*Tetranychus*] on apple trees.

WEISS (H. B.). **Undesirable Insect Immigration into New Jersey.**—*Canadian Entomologist, London, Ont.*, xlix, no. 9, September 1917, pp. 293–298, 1 plate.

The importation into New Jersey of *Gryllotalpa gryllotalpa* (European mole cricket) from Holland; *Blaberus discoidalis*, a tropical cockroach, from South America; *Cholus forbesii*, a tropical orchard weevil, from Colombia; and the Tingid, *Stephanitis pyrioides*, on azaleas from Japan is recorded. This immigration continues in spite of well-developed and well-enforced systems of inspection, owing largely to the impossibility of adequately examining the plants without destroying the tissues. Ordinary inspection cannot exclude all foreign pests, and such examination as would be perfectly thorough would not be tolerated by the importers, nor paid for by State governments. Inspection does, however, prevent an overwhelming rush of imported pests and checks and delays their spread to a considerable extent.

FENTON (F. A.). **Observations on *Lecanium corni*, Bouché, and *Physokermes piceae*, Schr.**—*Canadian Entomologist, London, Ont.*, xlix no. 9, September 1917, pp. 309–320, 19 figs.

Eulecanium (*Lecanium*) *corni*, Bch., probably a native of Europe, is one of the commonest and most widely distributed soft scales, being found as far north as Nova Scotia and Ontario, and southward into Mexico. Although it can live on numerous plants, a list of which is included in this paper, it seldom becomes of economic importance, serious outbreaks being of rare occurrence. The species is capable of much variation in form, size and colour even on the same host, and since it develops on numerous plants it is subject to a variety of normal environmental conditions. Parasitism and disease produce abnormally developed forms, and these, as well as immature individuals, have been described as separate and distinct species. The history of the insect's appearance in America is given, with an account of the life-history and a description of the various forms. The results of a number of experiments undertaken with a view to determining whether *E. corni* could be transferred from one host-plant to another, are given in a table. In several instances the attempts were unsuccessful, but this was due either to parasitism or dislodgement of the females.

The following Chalcidoidea have been bred from *E. corni*, which on some trees were so heavily parasitised as to be almost exterminated: *Coccophagus lecanii*, Fitch; *C. cinguliventris*, Gir.; *C. perflavus*, Gir. mss.; *Blastothrix longipennis*, How.; *Comys bicolor*, How.; *Euderus lividus*, Ashm.; and *Aphycus albiceps*, Ashm. The most abundant and effective parasite in Wisconsin is *Coccophagus lecanii*, while in California *Comys fusca*, How., which apparently has not been found in Wisconsin, seems to be the chief check. Predatory enemies include the larvae of the fly, *Leucopsis nigricornis*, Egger, which devour the eggs, while those of the Coccinellids, *Hyperaspis binotata*, Say, and *Chilocorus bivulnerus*, Muls., feed on the eggs and young. A fungus, *Cordiceps clavulatum*, destroys many of the adult females.

Physokermes piceae, Schr. (spruce scale) is a serious pest of *Picea abies* (Norway spruce) in Wisconsin; it has been introduced from Europe and is dependent upon spruce and pine as host-plants. The history

and distribution of this scale in the United States is discussed with its life-history as observed in Wisconsin. A Chalcid, *Holcencyrtus physokermis*, Gir., a recently described species apparently introduced with it from Europe, is effective in checking its spread; *Chiloneurus albicornis*, How., and several Encyrtids have also been bred from it.

CHAMBERLIN (W. J.). **An Annotated List of the Scolytid Beetles of Oregon.**—*Canadian Entomologist, London, Ont.*, xlix, no. 9, September 1917, pp. 321–328.

The species dealt with in this paper include *Cryphalus amabilis*, sp. n., which is described from specimens taken in Oregon in *Abies amabilis.* The beetles enter the trunk just below the branches and eat out a small chamber in which the eggs are deposited during the last week in August. These hatch in five days, the larvae working out in all directions and girdling the small limbs. The pupal cells are found in the cambium. *C. grandis,* sp. n., is described from Oregon in *Abies grandis. Dendroctonus monticolae,* Hopk., has caused heavy losses among various species of *Pinus* throughout Oregon. *D. engelmanni,* Hopk., has not previously been recorded from Oregon; two specimens were collected from their characteristic mines under the bark of *Picea engelmanni. D. brevicomis,* Lec., is the most serious pest of pine in the State, destroying many of the finest examples of yellow pine (*P. ponderosa*). *Scolytus* (*Eccoptogaster*) *unispinosus,* Lec., is widely distributed in the State, and attacks larch (*Larix occidentalis*), Douglas fir (*Pseudotsuga taxifolia*) and Engelmann spruce (*Picea engelmanni*). It was recently bred from thick bark taken from near the base of a large tree, where the species evidently spent its full life-cycle, never reaching the cambium. A new species resembling *S. unispinosus* has been taken from the twigs of a dying fir (*Abies grandis*). *S.* (*E.*) *subscaber,* Lec., is found throughout the State, the favourite host being *A. grandis,* some examples of which are so heavily infested that not one square inch is free from mines. A large number of less important species are also dealt with in this paper.

SMITH (L. B.). **Control of Some Garden Insects.**—*Virginia Truck Expt. Sta., Norfolk,* Bull. no. 23, 1st April 1917, pp. 489–506, 9 figs. [Received 28th September 1917.]

This bulletin has been compiled for the information of vegetable growers in Eastern Virginia, only those insects occurring in that region being included and the methods of control recommended being applicable to local conditions. Some general directions for insect control are given, spraying outfits being described and illustrated.

Potato pests include *Leptinotarsa decemlineata,* Say (Colorado potato beetle), against which powdered arsenate of lead used alone, or 1 lb. Paris green to 20 lb. air-slaked lime on the shoots as soon as they appear, are recommended. This should give protection until the plants are large enough to spray, when a mixture of 4 lb. arsenate of lead paste, 1 lb. Paris green and 50 U.S. gals. Bordeaux mixture 4 : 6 : 50 is advocated for application once before the eggs hatch and then once weekly until the early crop is harvested. *Epitrix* spp. (flea beetles) sometimes attack potato plants and eat small, round holes in the foliage. Bordeaux mixture, when used as a medium for applying

arsenicals, acts as a deterrent. *Macrosiphum solanifolii*, Ashm. (potato aphis), when occurring on potatoes, is controlled by 6½ oz. of nicotine sulphate to 50 U.S. gals. of the spray used for the Colorado potato beetle, with the omission of the Paris green, as this may, in combination with nicotine, cause injury to the foliage. This Aphid is also found attacking egg-plants, spinach, peppers and peas. Young egg-plants must be very carefully sprayed to avoid injury. As soon as the first Aphids are observed, a spray consisting of 5 oz. nicotine sulphate 40 per cent., 4 lb. fish-oil soap and 50 U.S. gals. water, should be applied, if possible by means of a compressed-air hand-sprayer with an extension rod; all insects should be hit with the spray. Egg-plants are also attacked by *Tetranychus* sp. (red spider). A strong stream of water from a hose will destroy many of these mites. Tobacco dust should be applied in the evening; the following morning the plants should have a liberal application of water, then the frames should be closed for six or eight hours, and afterwards watered again and ventilated. This treatment should be applied on alternate days until all the mites are killed. When they occur in the field the plants should be sprayed every few days with the mixture recommended for the control of potato aphis. Egg-plants attacked by *Epitrix* sp., when taken from the seed-beds for transplanting, should have their foliage immersed in Bordeaux mixture 2 : 3 : 50. A week or 10 days after transplanting, they should be thoroughly sprayed with Bordeaux mixture 4 : 6 : 50, to which has been added 4 lb. paste arsenate of lead to each 50 U.S. gals. This treatment should be continued once a week until the attacks cease and will kill any potato beetles that may attack the plants. Several species of cutworms occur on egg-plants, generally feeding on the stem; poison-bait consisting of 20 lb. bran, 1 lb. Paris green, 2 quarts molasses, 3 oranges or lemons and about 3½ U.S. gals. water should be scattered thinly on the ground in the evening, around, but not touching, the plants. One application at the time of setting, followed by another three or four days later, will usually be sufficient to protect the plants.

Cabbage and similar crops are attacked by *Pieris* (*Pontia*) *rapae*, L. Powdered arsenate of lead, either alone or mixed with an equal quantity of land plaster or air-slaked lime, dusted on the plants when the caterpillars begin feeding, has given excellent results. One or two applications are usually sufficient. As an alternative, 1 lb. Paris green may be mixed with 20 lb. lime or land plaster and applied dry. For a spray, 1½ lb. powdered arsenate of lead to 50 U.S. gals. water, with the addition of 2 to 3 lb. resin soap, is advocated. *Aphis brassicae*, L. (cabbage aphis) is abundant during May-June and September-December. A few plants are first attacked by large colonies and these can easily be detected by their yellow, wilted appearance. If these early Aphid colonies are thoroughly drenched once every 10 days during April, with 6½ oz. nicotine-sulphate and 5 lb. fish-oil soap to 50 gals. water, the infestation should be checked; but if it spreads, spraying must be continued every third day until all Aphids are destroyed. *Chortophila* (*Phorbia*) *brassicae*, Bch. (cabbage maggot) occasionally appears in seed-beds among plants grown for autumn setting. Planting should be deferred as late as possible, so that the last generation of flies will have deposited their eggs on other food-plants. Clean cultivation, and the removal of all Cruciferous weeds

during the summer, will greatly assist in checking this pest. If an outbreak should occur, the seed-bed should be ploughed deeply as soon as the plants have been set in the field. In regions where the pest is serious, cabbage plants for spring setting should be grown under cheese-cloth screens. *Murgantia histrionica*, Hahn. (harlequin cabbage bug) infests young kale during August and September. While a few individuals may be found throughout the winter, many bugs hibernate during January and February. The first and second generations feed chiefly on wild mustard. Kale should be planted as late as possible; if early kale is required, one or two rows planted on each side of the field about three weeks in advance of the regular planting will attract the insects, which can then be destroyed by spraying with pure kerosene oil; or 65 to 75 per cent. of the nymphs and 40 to 50 per cent. of the adults can be killed with a spray consisting of $6\frac{1}{2}$ oz. nicotine-sulphate and 8 lb. fish-oil soap to 50 U.S. gals. water; this should be applied under a pressure of 175 to 200 lb. *Rhopalosiphum persicae*, Sulz. (spinach aphis) is an omnivorous feeder, attacking spinach, cabbage, egg-plants and many garden crops. The contact sprays used for cabbage and potato Aphids are recommended against it.

Cucumbers, cantaloups, squash and melons are attacked by *Diabrotica vittata*, F. (striped cucumber beetle), which sometimes entirely destroys the first plantings, or injures the blossoms sufficiently to prevent the setting of the fruit. When only a few plants are grown, they should be protected by cheese-cloth netting until the vines begin to form. For field-crops, liberal applications of fish-scrap fertiliser when the first seedlings appear act as a deterrent to the beetles and stimulate the growth of the crop. Spraying has not given good results, as the insects avoid the poisoned leaves and attack only the new growth. Calcium arsenate seems to have no effect on the beetles, but further experiments are necessary with this substance. Heavy applications of air-slaked lime, tobacco dust or sulphur on the young plants are of decided value in preventing insect attacks. Seeds should be sown thickly and, after danger from this insect is past, they may be thinned to the required distance. Some species of *Smynthurus* (springtails) attack cucurbits, *S. hortensis*, Fitch, being commonly found on cucumber seedlings. Deterrents, such as tobacco dust, fish-scrap fertiliser and air-slaked lime are the most successful remedy. These should be applied liberally when the plants begin to appear above ground and again about one week later. *Diabrotica duodecim-punctata*, Oliv. (southern corn root worm) should be dealt with by the same methods as those advocated for *D. vittata*. *Aphis gossypii* (melon aphis) feeds on the under-side of cucurbit leaves, causing them to curl and die. The insects are first found abundantly on a few plants only, and these should be sprayed with $6\frac{1}{2}$ oz. nicotine sulphate 40%, and 4 lb. fish-oil soap to 50 U.S. gals. water. *Anasa tristis*, DeG. (squash bug), is troublesome in the nymphal stage and can then be killed by spraying with 1 lb. soap to 6 gals. water containing 1 oz. 40% nicotine sulphate. Where possible, the conspicuous brown eggs laid on the leaves should be destroyed, and adults may be attracted to the shelter of stones or boards placed near the plants, where they can be destroyed in the morning. *Melittia satyriniformis*, Hbn. (squash vine borer) is one of the most serious pests of squash and pumpkins. The larvae bore into the base of the stem, causing wilting

of the plants and frequently allowing access to fungi and bacteria. The vines should be destroyed as soon as the crop has been harvested. The ground should then be harrowed lightly and ploughed deeply the following spring, not later than 15th April, to bury the pupae. After the plants become infested, it is advisable to cover the crowns with soil in order to start new root-growth above the wounds caused by the larvae. A two or three year rotation of crops is recommended. *Epilachna borealis*, F. (squash ladybird beetle) is troublesome on water-melons, which are very susceptible to injury from sprays. Arsenate of lead powder at the rate of 2 lb. to 50 U.S. gals. water will kill the beetles without injury to plants. The first application should be made in June or when the beetles are first noticed on the plants, and should be continued once a week in order to protect the new growth, every portion of the plant being thoroughly covered with the spray. The vines should be well coated with spray when the eggs hatch, as the larvae will commence to feed on the stem near the spot where they hatched, whether arsenicals are present or not.

Bean and pea pests include *Ceratoma trifurcata*, Forst. (bean-leaf beetle), which feeds on the foliage and is frequently associated with *Diabrotica duodecimpunctata*; both of these pests can be controlled by spraying the plants with 1½ lb. of powdered lead arsenate to 50 U.S. gals. water, just before the blossoms open. *Aphis rumicis*, L. (bean aphis) infests many species of weeds, as well as cowpeas, beans, spinach, beets and clovers. When found on the stems and under-sides of the leaves of beans they can be controlled by spraying with 4 lb. fish-oil soap, 8¾ oz. 40% nicotine-sulphate, 50 U.S. gals. water. An arsenate of lead and fish-oil soap mixture must not be used on beans, as injury to the plants would result; the two materials may however be applied separately with a week's interval between the applications. *Acyrthosiphon* (*Macrosiphum*) *pisi*, Kalt. (pea aphis) infests pea crops in May and again in September. As the insect passes the winter largely on clover, it is not advisable to plant peas in the vicinity of clover fields. As soon as the first Aphids appear on the peas control measures should be applied. These have already been discussed [see this *Review*, Ser. A, iii, p. 155]. More recent experiments have led to the conclusion that more effective results can be obtained with the formula: 6½ oz. nicotine-sulphate 40%; 5 lb. fish-oil soap; water, 50 U.S. gals. This spray should be applied under high pressure so that it will reach all parts of the plants and the treatment should be repeated at least once a week during May and September. The small, early varieties of peas are recommended, as the later ones are more liable to injury and more difficult to spray. The plants should be set in rows four feet apart so that the sprayer may be driven between them. The practice of intercropping peas with cucumbers or beans in the spring or with beans and strawberries in the autumn is recommended.

Onions are attacked by *Thrips tabaci*, Lind. (onion thrips), which may be controlled by spraying with 4 lb. fish-oil soap and 8¾ oz. nicotine-sulphate 40%, to 50 U.S. gals. water. The spray must be applied thoroughly, as many of the insects hide in the axils of the leaves. Three or four applications, at about four days' interval, are usually necessary to control them.

Cushman (R. A.). **Eight New Species of reared Ichneumon-Flies, with Notes on some other Species.**—Separate, no. 2216, dated 9th August 1917, from *Proc. U. S. Nat. Mus., Washington, D.C.,* liii, pp. 457–469.

The North American Ichneumonids dealt with in this paper include *Microcryptus osculatus,* Prov., bred as a primary parasite from the larvae of a sawfly, *Taxonus* (*Ametastegia*) *glabratus,* Fall. A key is given to the North American species of the genus *Bathythrix, B. tibialis,* sp. n., bred from *T. glabratus,* being probably a secondary parasite. *Aenoplex nigrosoma,* sp. n., was bred from the same host and a key to the N. American species of this genus is given.

Spilocryptus polychrosidis, sp. n., was bred from *Polychrosis viteana,* Clem.; *Caenocryptus newcomeri,* sp. n., and *Chaeretymma minuta,* sp. n., from *Taxonus glabratus*; *Scambus ephialtoides,* sp. n., from *Rhyacionia* (*Evetria*) *siskiyouana*; *Itoplectis obesus,* sp. n., from pupae of the fruit-tree leaf-roller [*Cacoecia argyrospila*] and of the bud-moth [*Eucosma ocellana*]; and *Glypta evetriae,* sp. n., from *Rhyacionia* (*Evetria*) *taxifoliella.*

Girault (A. A.). **Notes and Descriptions of Miscellaneous Chalcid-Flies (Hymenoptera).**—Separate, no. 2213, dated 10th August 1917, from *Proc. U. S. Nat. Mus., Washington,* liii, pp. 445–450.

The species dealt with in this paper include *Tumidiscapus oophagus,* sp. n., reared from eggs of a grasshopper, *Oxya velox,* from Southern India; *Abbella americana,* sp. n., from Jassid eggs in Utah, four females of *Gonatocerus utahensis,* sp. n., being reared with this species; and *Trydymus aphidis,* sp. n., reared from *Lasioptera vitis* in New York.

Feytaud (J.). **L'Erinose.** [Erinosis].—*Rev. Viticulture, Paris,* xlvii, no. 1201, 5th July 1917, pp. 10–12, 1 plate.

The mite, *Eriophyes* (*Phytoptus*) *vitis,* is now known to be the cause of a disease of vine-leaves which was formerly considered to be cryptogamic. The four-legged larvae of this mite are reproductive and give rise to several generations in the course of a summer. As winter approaches, reproduction ceases and the mites hibernate under the bark of the stock and the bud-scales, encyst and transform in the spring into six-legged larvae, which develop into sexual, eight-legged adults, and these oviposit on the young leaves. On the upper side of the leaves, where the galls are found, only the four-legged forms are observed. The damage is generally confined to the leaves, and is not very important, but occasionally extends to the flowers, when it becomes more serious. The hot-water treatment of the vines for *Sparganothis pilleriana,* decortication against *Clysia ambiguella,* and whitewashing against Coccids, destroy many of the hibernating larval mites. The removal and burning of the first leaves attacked in the spring reduces the numbers of succeeding generations, though sulphur treatment, after clearing out the vines, checks the increase of *E. vitis* and the development of galls more successfully than any other method. Plunging the cuttings taken from infested vines into hot water is also recommended.

Vœux de la Confédération générale des Vignerons. [Resolution passed by the General Confederation of Vinegrowers.]—*Rev. Viticulture, Paris*, xlvii, no. 1201, 5th July 1917, p. 15.

The Administrative Council, in consequence of a resolution passed by the General Confederation of Vine-growers and in view of the representations of the Departmental Councils that the use of soluble arsenates is no more dangerous to public health than the use of insoluble arsenical salts, requests that the use of the former salts shall be definitely authorised under the same conditions as insoluble arsenical ones and that Article 11 of the decree of 15th September 1916 [see this *Review*, Ser. A, v, p. 47] shall be modified in this sense.

La Pyrale et les Traitements arsenicaux. [*Sparganothis pilleriana* and Arsenical Treatments.]—*Progrès Agric. Vitic., Montpellier*, lxviii, no. 28, 15th July 1917, pp. 55–56.

Sparganothis pilleriana has been causing considerable damage in many vineyards, the reason being that the majority of vine-growers have been unable to carry out the winter treatments which destroy the greater part, if not all, of the larvae hidden under the bark. Both labour and coal necessary for the hot spraying have been lacking, while the prohibition of the use of soluble arsenicals has prevented many vine-growers from resorting to arsenical whitewashing. It is hoped that the protest issued by the Confederation of Vine-growers [see above] against this prohibition will be considered in time to carry out the necessary measures during the winter of 1917.

Akerman (A.) & Tedin (H.). *Contarinia tritici*, **a Dipteron injurious to Wheat and Barley in Sweden.**—*Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, viii, no. 7, July 1917, p. 1067. [Abstract from *Sveriges Utsäde Förenings Tidskrift, Malmoe*, xxvii, pp. 24–33, and 34–42, 1917.] [Received 21st September 1917.]

The larvae of *Contarinia tritici* did considerable damage to the different varieties of wheat during the summer of 1916. The damage, which varied from 5 to 10 per cent. and in exceptional cases amounted to 60 per cent. of the yield of grain, was caused by the insect depositing its eggs in the flowers of wheat and other cereals immediately after they had come into ear. Bearded and beardless varieties were equally liable to attack, but the varieties that suffered most were early ones, coming into ear from the 27th to the 29th of June, while those that came into ear from the 1st to the 3rd July suffered least. The same thing was observed in barley fields in other parts of Sweden, and does not imply a higher specific resistance on the part of the late varieties, but merely points to the fact that the females of this Cecidomyid are more numerous in June; in other conditions of temperature and moisture precisely the opposite state of affairs might occur.

Ranninger (R.). *Coeliodes fuliginosus*, **a Coleopteron injurious to the Poppy in Austria.**—*Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, viii, no. 7, July 1917, p. 1068. (Abstract from *Zeitschrift für angewandte Entomologie, Berlin*, iii, pp. 383–387, December 1916.) [Received 21st September 1917.]

The larvae of *Coeliodes fuliginosus* attack poppy plantations by boring into the upper part of the roots, causing them to turn black

and the leaves to become brown and die. There is only one generation in the year, the larva pupating in July and the adult beetles appearing four weeks later, in late August or early September; they live on various plants, including the young leaves of newly thinned poppies, and hibernate in the soil, from which they emerge in April. Preventive measures include early sowing in the spring; wide planting; strengthening the plant to render it resistant by dressing the ground with saltpetre when thinning out; well manuring the preceding crop with farmyard manure; clean cultivation of the poppy fields and hilling up the plants.

DEL VECCHIO (C.). *Phytomyza flavicornis,* **a Dipteron injurious to the Milan Cabbage in Lombardy.**—*Mthly. Bull. Agric. Intell. & Pl. Dis., Rome,* viii, no. 7, July 1917, p. 1069. (Abstract from *Natura, Milan,* viii, January to April 1917, pp. 75–77, 2 figs.). [Received 21st September 1917.]

The whole of the Milan cabbages in the experimental field of the Royal Higher School of Agriculture of Milan were attacked in September 1915 by the larvae of *Phytomyza flavicornis,* Fall., which injured the outer parts of the roots, causing the small inner leaves to atrophy almost entirely. The larvae pupated in the soil during the second half of October, and the adult flies emerged in the following summer. In the same field other roots were found badly damaged by another Dipteron, *Chortophila brassicae,* Bch., and *Aphis brassicae* occurred on some of the plants.

POPOFF (M.) & JOAKIMOFF (D.). **Observations on the Vine Phylloxera in Bulgaria.**—*Mthly. Bull. Agric. Intell. & Pl. Dis., Rome,* viii, no. 7, July 1917, pp. 1070–1071. (Abstract from *Zeitschrift für angewandte Entomologie, Berlin,* iii, 3, pp. 367–382, December 1916.) [Received 21st September 1917.]

The method of cultivation occurring throughout Bulgaria known as "asmas," which means the growing of vines around dwellings, or climbing upon trees, walls and other supports, renders them much more resistant to *Phylloxera* than those pruned and cultivated in the open. The vines are from 4–5 metres apart, the soil is never worked, and as the roots sometimes encounter obstructions they are obliged to penetrate deeply into the soil, where they develop well, pruning being restricted to superfluous shoots. In this way vines are obtained resembling trees, which often live for 100 years. This method of cultivation is very unfavourable to *Phylloxera* because in the case of vines with a deep and well developed root system, the lower roots are sufficient to support the normal life of the plant, the pest being able to live only on the upper roots; the entry of the insects into the soil is more difficult when the ground is not periodically worked; by limiting pruning to a minimum, branches and leaves are formed which are very resistant. When manuring is necessary for such vines, it should be done before the Aphids have begun to migrate, and the earth should be thoroughly pounded to prevent them from effecting an entry.

Escherich (K.). *Clytus* (*Plagionotus*) *arcuatus*, **a Coleopteron injurious to the Oak in Germany.**—*Mthly. Bull. Agric. Intell. & Pl. Dis., Rome,* viii, no. 7, July 1917, pp. 1071–1072. (Abstract from *Zeitschrift für angewandte Entomologie, Berlin,* iii, pp. 388–397, December 1916.) [Received 21st September 1917.]

The Longicorn, *Clytus arcuatus,* especially infests felled timber, that stored in the shade being much less attacked than that in full sunlight, owing to the fact that this beetle is particularly fond of light. It is one of the worst enemies of oaks in the Palatinate, where its appearance is an absolute calamity, as it increases rapidly in numbers and also attacks the wood of poorly developed trees, boring long galleries beneath the bark. The natural enemies of *C. arcuatus* are not very numerous or important; it is parasitised by an Ichneumonid, and woodpeckers are known to destroy it. To avoid damage, sickly trees should be removed from the plantation; trunks should be removed immediately after felling (at the end of April at the latest), or, if that is impossible, they should be stored in the shade; the felled trunks might be whitewashed, to prevent the insect from ovipositing.

Hutson (J. C.). **Insect Pests in British Guiana in 1916.**—*Agric. News, Barbados,* **xvi, no. 400, 25th August 1917, pp. 266–267.**

These notes are taken from the general report of Mr. H. W. B. Moore on insect pests during 1916, as in previous years [see this *Review,* Ser. A, ii, p. 57, v, p. 148], and includes an account of a new small moth-borer of sugar-cane belonging to the family Pyralidae. It is widely distributed, but appears to have more or less definite times for appearing. Its method of attack differs from that of other small borers, in that it bores straight to the growing-point or heart and then eats out a small cavity, instead of making a longitudinal tunnel. The entrance hole is circular and very small, and the boring has some resemblance to an incipient attack by *Diatraea saccharalis.* The caterpillar pupates outside the boring, in a slight whitish cocoon. The small moth-borers, *Diatraea saccharalis* and *D. canella,* are still doing serious damage and further control work in the early stages of the sugar-cane is necessary, by taking parasitised egg-clusters from canes about to be cut, and distributing them in young fields. Control work against the large moth-borer, *Castnia licus,* is very uneven, the collection of caterpillars and moths having been neglected on many estates. The small black hard-back, *Dyscinetus bidentatus,* caused serious damage on two estates, though it was reduced by a systematic collection of the beetles, which destroy the young cane-shoots and often bore into the base of the plant. A closely related species, *D. barbatus,* occurs in Antigua, St. Kitts, and Barbuda. The Scoliid wasp, *Tiphia parallela,* was found to be a parasite of *D. bidentatus* in British Guiana. There was a severe outbreak of this pest on one estate, where over 4,000,000 adults and nymphs were destroyed during the season by sweeping the drains in the worst-infested fields with wide-mouthed nets. The eggs of this pest were found to be deposited in dry grass or cane-blades or between dry cane-blades and the earth. The grass looper, *Pelamia* (*Mocis*) *repanda,* attacked the blades of young canes on several estates; these outbreaks seem to occur annually after the mid-year rains, while in some of the West Indian

islands they are experienced only at long intervals, probably because the pest is kept in check by its natural enemies. In these islands the insect is known as the Guinea grass moth or Guinea grass worm, but the caterpillars are very fond of Para grass, and occasionally attack other grasses. The rice worm (*Laphygma frugiperda*), known as the corn-ear worm in the West Indies, and the fall army worm in the United States, did a small amount of damage to sugar-cane in British Guiana.

Ritchie (A. H.). **Pea Weevils in the Fields and in Storage.**—*Jl. Jamaica Agric. Soc., Kingston,* xxi, no. 8, August 1917, pp. 313–315. [Received 27th September 1917.]

Against the pea weevil, *Bruchus* sp., peas should be planted so that the ripening season coincides with what is normally a dry spell, thereby reducing the time possible for weevil attack. The crop should be gathered and cured as quickly as possible and the contained insects killed. Since the immature stages cannot stand long exposures to high temperatures, thinly spreading out the peas on a strongly sun-baked surface, such as a corrugated iron sheet, will dispose of most of the eggs, larvae and pupae. The heat method, being simple and safe, is superseding fumigation in flour mills. When this method is impracticable, fumigation with carbon bisulphide, followed by careful storage to prevent re-infestation, will prove an effective control.

Fullaway (D.). **Division of Entomology.**—*Hawaiian Forester & Agriculturist, Honolulu,* xiv, no. 6, June 1917, pp. 154–155, and xiv, no. 7, July 1917, pp. 190–191. [Received 27th September 1917.]

During the months of April and May the insectary handled 71,600 pupae of the melon fly [*Dacus cucurbitae*] from which 3,665 individuals of *Opius fletcheri* were bred and distributed. The following fruit-fly and horn-fly parasites were also distributed:—*Tetrastichus,* 5,000; *O. humilis,* 285; *Diachasma fullawayi,* 210; *D. tryoni,* 225; *Spalangia cameroni,* 60; and *Paranagrus,* the corn leaf-hopper parasite, 13,625.

Ehrhorn (E. M.). **Division of Plant Inspection.**—*Hawaiian Forester & Agriculturist, Honolulu,* xiv, no. 6, June 1917, pp. 151–153, and xiv, no. 7, July 1917, pp. 187–189. [Received 27th September 1917.]

Pests intercepted during the month of April included beetles in the portions of trees to which orchids were attached, and a few ants found in the packing.

During May shipments of plants from California were fumigated on account of being infested with Aphids and ants; two baskets of garlic were found infested with the larvae of a Lepidopteron, probably *Ephestia elutella,* and were fumigated with carbon bisulphide before delivery; four cases of roses from San Francisco were fumigated for rose aphis. A crate of turnips, which was infested with the turnip maggot, was ordered to be dumped at sea.

Four packages of beneficial insects were received for the Hawaiian Sugar Planters' Association, all soil and packing being destroyed.

Destruction of Insect Pests on the French Riviera.—*Jl. Roy. Soc. Arts, London,* lxv, no. 3384, 28th September 1917, p. 756.

The recent appearance of *Icerya purchasi* among the orange and lemon plantations in the department of the Maritime Alps has led to the entomological section of the Ministry of Agriculture taking steps to arrest its spread. Unfortunately many growers have cut down and burnt their trees, being probably unaware that the introduction of *Novius cardinalis* was successfully employed against this scale-insect in the same neighbourhood a few years ago. An insectarium is now being established at Mentone, where this Coccinellid will be reared and supplied gratis, together with advice to all applicants.

C. T. **The Earwig.**—*Gardeners' Chronicle, London,* lxii, no. 1605, 29th September 1917, p. 132.

As a trap for earwigs [*Forficula auricularia*], an old broad-bean stem is recommended as being as effective as a flowerpot and less unsightly. Lengths of 6–8 in. are placed among the lower branches of fruit trees, on chrysanthemum pots, under dahlias, etc. The insects thus caught may be killed by tapping the end of these stems on a pail containing a little water with a dash of paraffin.

Webster (R. L.). **The White-marked Tussock Moth.**—*Iowa State Coll. Agric. Expt. Sta., Ames,* Circ. no. 33, December 1916, 4 pp., 3 figs. [Received 28th September 1917.]

Hemerocampa leucostigma (white-marked tussock moth) has been reported as occurring abundantly in various districts in Iowa during the autumn of 1916. While this is not a new insect in Iowa, it seldom causes such wide-spread notice. The life-history and control of this moth have already been dealt with [see this *Review,* Ser. A, v, p. 174].

LEGISLATION.

L'Emploi des Arsenicaux solubles en Viticulture. [The Use of Soluble Arsenicals in Vine-growing.]—*Bull. Agric. Algér.-Tun.-Maroc, Algiers,* xxiii, no. 9, September 1917, p. 199.

In view of the difficulties that would be encountered by vine-growers under present conditions with regard to hot-water and other treatments against *Sparganothis pilleriana, Clysia ambiguella* and *Polychrosis botrana,* in consequence of the scarcity or the cost of labour and materials, the French Minister of Agriculture has decided, by a decree dated 5th August 1917, to extend (for the space of one year) the period allowed to manufacturers and dealers for the sale of preparations based upon soluble arsenical compounds destined for winter treatments of grape-vines and fruit trees.

Consequently, these preparations may be sold and vine-growers may use them from the end of the coming vintage until 1st May 1918, for the winter treatment only of vines and fruit trees.

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THE REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

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Moreira da Costa Lima (A.). **Relatorio sobre a Lagarta rosea do Capulho nos Agodoeiros do Nordeste.** [Report on the Pink Boll Worm in the Cotton Districts of North-eastern Brazil.]—*Rio de Janeiro*, 1917, 50 pp., 4 plates.

This is a report to the Brazilian Minister of Agriculture on *Pectinophora* (*Gelechia*) *gossypiella* (pink boll worm) infesting cotton in the north-eastern States of the Republic. The introduction of this pest, which was discovered early in 1916 in the State of Ceará, may date back a long time and its spread is anticipated to be slow. The larvae also attack the seed of *Hibiscus* and its allies. *Pediculoides ventricosus*, Newp., preys on *P. gossypiella* in Brazil, and two ants, *Monomorium* sp. and *Cremastogaster* sp., have been noticed attacking it accidentally. A Bethylid, *Perisierola nigrifemur*, Ashm., a Chalcid, *Solindemia* sp., and two Braconids, *Coelothorax* sp. and *Bracon* sp., were taken from infested bolls. The best that can be expected of these natural enemies is a check on an excessive increase of the pest, the usual remedial measures for which are briefly described.

This report closes with notes on the following further insects on cotton in the north-east of Brazil:—In the seed: a Bruchid, *Spermophagus* sp., an Anthribid, *Araecerus fasciculatus*, De G., a Curculionid, *Hyperodes* sp., and a moth, *Pyroderces simplex*, Wlsm. At Fortaleza the author found a larva, apparently that of *Heliothis obsoleta*. On the plants: a Noctuid, *Alabama* (*Anomis*) *argillacea*, Hbn., a cotton-stainer, *Dysdercus* sp., *Aphis gossypii*, Glov., and a scale, probably *Hemichionaspis minor*, Mask.

La Tinya de les Prunes. [*Cydia funebrana.*]—*Rev. Inst. Agríc. Catalan de S. Isidro, Barcelona*, lxvi, no. 15, 15th August 1917, pp. 234–236.

Against *Cydia* (*Carpocapsa*) *funebrana* injuring plums in Catalonia, the usual remedies are advised, including light-traps, alkaline washes, sulphur sprays (applied after blossoming), removal of infested fruit, and shelter-traps. During the blossoming period, a spray containing 1 lb. sodium arsenate and 5 lb. lime (paste) in 50 gals. water was tried and appeared to give good results.

Dawe (M. T.). **Relación de un Viaje por el Río Magdalena, por el Departamento del Magdalena y por la Península de la Goajira (Colombia).** [Account of a Journey on the Magdalena River, in the Department of Magdalena and in the Goajira Peninsula (Colombia).]—*Memoria Ministro Agric. y Comercio al Congreso de 1917, Anexos; Bogotá*, 1917, pp. 63–116.

The scale, *Hemichionaspis minor*, Mask., is recorded as infesting cotton at Tucarara.

Cimatti (V.). **Il Piretro insetticida.** [Pyrethrum Insecticide.]—*Riv. Agric., Parma*, xxiii, no. 38, 21st September 1917, p. 501.

Pyrethrum (*Chrysanthemum cinerariaefolium*) is easily grown in Italy on stony, arid ground unsuited for other plants. The seed used for sowing must be taken from wild plants and can be stored for four

years. The flowers are dried in the shade and ground up, the powder acquiring its full virtue after slight fermentation for three months. It must be stored in air-tight containers. Adulteration with camomile or artemisia is sometimes practised. Closed pyrethrum flowers fetch about £6–£7 per cwt. on the Italian market at present.

van Eecke (R.). *Oryzaephilus surinamensis,* **L., schadelijk voor Bloembollen.** [*O. surinamensis* injurious to Flower-bulbs.]—*Entom. Ber. Nederlandsch. Entom. Vereen, The Hague,* iv, no. 93, 1st January 1917, p. 340. [Received 27th September 1917.]

Flower-bulbs growing in the open at Lisse were injured by the *Sylvanus* Cucujid (*Oryzaephilus*), *surinamensis,* L. The larvae feed on dry apples, dry figs, bran, etc., and also on the buck-wheat husks used as a covering for the bulb fields. The adults leave this cover and attack the bulbs.

Oudemans (A. C.). **Boekweitdoppen als Dek voor Bollevelden.** [Buck-wheat Husks as a Cover for Bulb-fields.]—*Entom. Ber. Nederlandsch. Entom. Vereen., The Hague,* iv, no. 93, 1st January 1917, p. 340. [Received 27th September 1917.]

Besides the pest mentioned in the preceding paper, the buck-wheat husks harbour other insects, and also *Tyroglyphus farinae,* L. (flour mite), which seems to thrive in hyacinth bulbs. The husks should therefore be exposed to a scorching heat before being spread over the fields.

Champion (G. C.). *Pediacus depressus* **(Herbst), a Species frequenting Pines in the Woking District.**—*Entomologists' Mthly. Mag., London,* liii, no. 639, August 1917, pp. 173–174.

The pines felled at Woking in 1916, now contain innumerable larvae, pupae, and imagines of *Tomicus laricis* and *Hylastes palliatus* in their bark, but *H. ater* and *Myelophilus piniperda,* both destructive at times in the district, are only just in evidence, these latter attacking more recently felled trees. The carnivorous beetle, *Pediacus depressus,* has appeared in some numbers among stacked pine logs.

Pierce (W. D.). **Notes on a Southern Trip.**—*Proc. Entom. Soc., Washington, D.C.,* xviii, no. 4, December 1916, pp. 206–207.

The weevil, *Prionomerus calceatus,* Say, was originally described as mining the leaves of *Magnolia,* but has been recently found destroying those of *Liriodendron* and *Sassafras,* though these were never attacked when growing side by side with *Magnolia.*

The common cow-pea weevil, which attacks the terminal buds of cotton, was found feeding freely on the tender stems of *Smilax, Ambrosia, Sassafras, Liquidambar, Rubus,* and *Melia,* indicating the method by which some common species that live on cultivated crops pass the season preceding the development of their natural food-plants.

The flat galls of *Phylloxera caryae-avellana,* Riley, were found to be infested by the larvae of *Anthonomus hicoriae,* Pierce; several other weevils of the same group also breed in *Phylloxera* galls.

ROHWER (S. A.). *Diprion simile* in North America.—*Proc. Entom. Soc., Washington, D.C.*, xviii, no. 4, December 1916, pp. 213–214.

This sawfly has been recorded as established in five towns in Connecticut [see this *Review*, Ser. A, iv, p. 286] and is now reported from New York; in every case it occurs in nurseries, where it had been introduced on plants from Holland.

HEIDEMANN (O.) & MCATEE (W. L.). **Two New Species of Lace Bugs.**—*Proc. Entom. Soc., Washington, D.C.*, xviii, no. 4, December 1916, pp. 217–219, 1 pl.

The species dealt with are *Leptoypha distinguenda*, sp. n., which abounds on witch-hazel (*Hamamelis*) from early spring till late autumn, and *Acalypta grisea*, sp. n., collected under stones in April.

BENTLEY (G. M.). **Benefits to be derived from Observing, Collecting and Studying Insects.**—*Tennessee State Bd. Entom., Knoxville*, vi, no. 1, Bull. no. 20, March 1917, 32 pp., 23 figs.

This bulletin describes in a popular manner the more common species of the various orders of insects, with notes on their habits, and gives instructions and hints on collecting. A key to the orders is given, with the characteristics that apply to most of the economic forms.

CHRÉTIEN (P.). **Contribution à la Connaissance des Lépidoptères du Nord de l'Afrique. Notes biologiques et critiques.** [A Contribution to the Knowledge of North African Lepidoptera. Biological and critical Notes.]—*Ann. Soc. Entom. France, Paris*, lxxxv, no. 3-4, January-May 1917, pp. 369–502.

In this work the author gives notes and observations on the life-history of Lepidoptera from Morocco, Algeria and Tunis. Among the large number whose host-plants in the larval stage are definitely known the following are of some economic importance: *Prodenia litura*, F., a veritable scourge to the oasis cultivation of cotton, owing to its voracity and rapid multiplication; the Noctuid, *Eublemma* (*Thalpochares*) *velox*, Hb., on asparagus, living in the interior of the berry; *Phytometra* (*Plusia*) *daubei*, Bdv., on *Daucus carota* (carrot); *Earias insulana*, Bdv., recorded as destroying an experimental oasis plantation of *Gossypium herbaceum* (cotton); *Blastobasis phycidella*, Z., the larvae of which are found in winter under the bark of trees, principally *Ficus*; *Phyllorycter* (*Lithocolletis*) *endryella*, Mann., and *P.* (*L*). *joviella*, Const., the mines of which are found in winter on *Quercus coccifera*, and the latter also on *Q. ilex*; *Tinea ankerella*, Mann., and *T. cloacella*, Hw., both found in numbers on *Q. suber*, the cork-oak.

GREEN (E. E.). **Additions to the Wild Fauna and Flora of the Royal Botanic Gardens, Kew: xv. Coccidae.**—*Bull. Miscell. Information, R. Bot. Gardens, Kew; London*, 1917, no. 2, pp. 73–76.

A complete list is given in this paper of all the COCCIDAE, 42 in number (exclusive of indigenous open-air species), that are known to have occurred in the plant-houses of the Royal Botanic Gardens at Kew.

These are: *Icerya aegyptiaca*, Dougl., *Orthezia insignis*, Dougl., *Asterolecanium bambusae*, Bdv., *Dactylopius* (*Coccus*) *tomentosus*, Lam.,

Gymnococcus agavium, Dougl., *Ripersia filicicola*, Newst., *Pseudococcus citri*, Risso, a common greenhouse pest, *P. adonidum*, L. (*longispinus*, Targ.), the most widely distributed Coccid in the Kew houses, *P. nipae*, Mask., on various palms (especially on *Cocos*, *Kentiopsis*, and *Sabal*), *Vinsonia stellifera*, Westw., *Pulvinaria floccifera*, Westw., common on orchids, *Saissetia* (*Lecanium*) *hemisphaericum*, Targ., *S.* (*L.*) *nigra*, Nietn., *S.* (*L.*) *depressa*, Targ., abundant on *Musa*, *S.* (*L.*) *oleae*, Bern., *Coccus* (*L.*) *hesperidum*, L., *Lecanium signiferum*, Green, hitherto recorded only from India and Ceylon, *Coccus* (*L.*) *longulus*, Dougl., *Eucalymnatus* (*L.*) *perforatus*, Newst., common on various palms, *Pinnaspis buxi*, Bch. (*pandani*, Comst.), *Hemichionaspis aspidistrae*, Sign., *Diaspis boisduvali*, Sign., *D. echinocacti*, Bch., (*calyptroides*, Costa), *D. carneli*, Targ., *Aulacaspis* (*D.*) *pentagona*, Targ., *A.* (*D.*) *persimilis*, Ckll., *Howardia biclavis*, Comst., *Chrysomphalus aonidum*, L. (*Aspidiotus ficus*, Ashm.), *A. hederae*, Vall. (*aloes*, Bdv.), *Chrysomphalus* (*A.*) *personatus*, Comst., *Aspidiotus spinosus*, Comst., *Chrysomphalus* (*A.*) *dictyospermi*, Morg., *A. cyanophylli*, Sign., *Chrysomphalus* (*A.*) *perseae*, Comst., *Gymnaspis aechmeae*, Newst., *Parlatoria pergandei*, Comst., *Fiorinia kewensis*, Newst., *Poliaspis cycadis*, Comst., *Lepidosaphes pinnaeformis*, Bch., *Lepidosaphes* sp. n., and *Ischnaspis filiformis*, Dougl., abundant on various palms.

Two Troublesome Beetles.—*Botanical Jl., London*, v, no. 5, September 1917, p. 73.

Byturus tomentosus, F. (raspberry beetle) is a serious pest of raspberries, blackberries and loganberries, while the adults also feed on hawthorn, apple and pear blossoms, appearing in late spring and early summer, destroying some blossoms and ovipositing in others. Winter is passed in the pupal stage, either in the ground or on the canes or supporting stakes. In this stage large numbers can be killed by burning the cuttings from the autumn pruning, and the adults may be destroyed by shaking the canes on dull days and collecting the beetles on tarred boards. The ground may be treated with paraffin and ashes, or with soot and lime in the early spring, while spraying with lead arsenate at the time the blossoms open has proved effective. As this beetle may migrate to raspberries from wild blackberries, any of these growing in the vicinity should be destroyed.

Balaninus nucum, L. (nut weevil) attacks the cob, filbert, hazel and oak, the single egg being laid in a hole bored in the young nut and being pushed well into the interior. The larva escapes and hibernates in the soil, pupation taking place in early spring, at which time the insects may be exposed to the attacks of birds by turning over the ground beneath the trees. When the adult weevils appear about midsummer, they may be destroyed by shaking the trees over tarred boards.

Oshima (M.). **Three New Species of Termites from Caroline Islands.**—*Annotat. Zool. Jap., Tokyo*, ix, no. 3, July 1917, pp. 195–200, 4 figs. [Received 1st October 1917.]

The species described in this paper are *Calotermes* (*Neotermes*) *kanehirae*, sp. n., *Arrhinotermes ponapiensis*, sp. n., and *Eutermes* (*Grallatotermes*) *brevirostris*, sp. n.

Merrill (D. E.). **Grasshopper Control.**—*New Mexico Agric. Expt. Sta., State College, Las Cruces,* Bull. no. 102, April 1916, 32 pp., 19 figs. [Received 1st October 1917.]

This bulletin is the outcome of investigations carried on since 1912. Every part of the State of New Mexico is liable to grasshopper damage, the most injurious species being *Melanoplus differentialis, M. bivittatus* and *M. atlantis*; other species causing less serious loss are *M. femur-rubrum, Hadrotettix trifasciatus, Schistocerca venusta* and *Brachystola magna.* The damage is chiefly caused by non-migratory species. Natural enemies such as birds, poultry, mites and an unidentified fly, assist in control, but are not always sufficiently numerous to keep the locusts in check. Lucerne, garden and vegetable crops, grain and young fruit trees suffer most from grasshopper attack. The usual remedial measures are advocated; hopperdozers are described and formulae given for poison-baits. Emphasis is laid upon the importance of preventive measures and the destruction of breeding-places and eggs. It is suggested that remedial measures and the necessary treatment of waste land should be compulsory.

A. N. **Acetic Acid as an Insecticide.**—*Gardeners' Chronicle, London,* lxii, no. 1606, 6th October 1917, p. 142.

Acetic acid or vinegar is stated to be a powerful insecticide, and if volatilised in a small enamelled pan by means of a spirit lamp will free greenhouses from whiteflies and Aphids.

McIndoo (N. E.) & Sievers (A. F.). **Quassia Extract as a Contact Insecticide.**—*Jl. Agric. Research, Washington D.C.,* x, no. 10, 3rd September 1917, pp. 497–531, 3 figs., 9 tables.

Official quassia is derived from either *Aeschrion (Picrasma) excelsa,* Swz., family Simarubaceae, known commercially as Jamaica quassia, or from *Quassia amara,* L., a plant of the same family, known commercially as Surinam quassia. There are several other plants the wood of which contains an active constituent identical with, or similar to quassiin, the bitter principle and main constituent of quassia. These include *Simaruba amara,* Aubl., *S. versicolor,* St. Hil., *Aeschrion (Picrasma) quassioides,* Benn., and *Ailanthus excelsa,* Roxb.

In the experimental investigation of the effectiveness of this substance as an insecticide the following Aphids were employed: *Macrosiphum liriodendri,* Mon. (tulip-tree aphis), *M. rosae,* L. (rose aphis), *A. rumicis,* L. (nasturtium aphis), *A. brassicae,* L. (cabbage aphis), *Acyrthosiphon (Macrosiphum) pisi,* L. (pea aphis), *Aphis* sp. on *Colutea arborescens* (bladder senna), *Phyllaphis fagi,* L. (woolly beech aphis), and *Chaitophorus populicola,* Thos., on Carolina poplars. The formula recommended against the hop aphis [*Phorodon humuli*] was found efficient on the nasturtium aphis only, although it was tested upon six other species. This solution was composed of 6·3 gm. of quassia chips soaked for 24 hours in 2,000 c.c. of water, fish-oil soap being subsequently added in the proportion of 1·6 lb. soap to 100 U.S. gals. water. Caterpillars of *Hyphantria cunea,* Dru. (fall web-worm) and larvae of *Leptinotarsa decemlineata,* Say. (potato beetle) sprayed with a similar mixture were merely reduced to a state of stupor, from which

they recovered the following day. Quassiin powder dusted on web-worms had the same effect on them, but caterpillars of *Bombyx mori*, L. (silkworm) were killed.

Experimental tests for selection of effective formulae led to the conclusion that in making the extract a relatively long period of soaking is essential in order to get the maximum quantity of quassiin in solution; boiling the chips in water for 4 hours extracts $1\frac{1}{2}$ times the amount obtained by soaking them in cold water for 24 hours; the smaller the chips and the finer the quassia powder used, the greater the quantity of extract obtained; the larger the quantity of water used as a solvent, the greater the quantity of extract; the addition of lye and soap to the water materially increases the effectiveness of the extract.

As regards the pharmacological effects of quassiin, it was found that exhalations from quassiin powder killed Aphids, but that those from quassia chips, quassia powder, and from solutions containing quassiin extract and quassia extract were ineffective. It was also shewn that quassia extracts affected Aphids only, and that quassiin extract does not act as a stomach poison upon bees (*Apis mellifica*) or *Rhagoletis pomonella*. Quassia powder dusted on insects had no effect, but quassiin powder killed them by affecting the nervous system. Quassia and quassiin spray solutions kill Aphids, if used sufficiently strong, their effectiveness being increased by the addition of soap. While nicotine acts quickly and causes pronounced symptoms, quassiin acts very slowly and causes but few, feeble symptoms, the Aphids slowly dying in a state resembling coma.

It is concluded that, owing to the poor insecticidal properties of quassiin and its expense, quassia extract can never become a general insecticide for all Aphids. A spray solution made by soaking 22 lb. quassia chips in 100 U.S. gals. fish-oil soap solution (1·6 lb. soap to 100 U.S. gals. water) for 24 hours, was efficient on only two out of six species of Aphids tested, while the result was about equal to that obtained by using nicotine sulphate solution; the expense was nearly the same, while owing to its slower action it was much less reliable, as a shower of rain or the migration of the Aphids nullifies its effect. A bibliography of 48 works dating from 1779 is given.

Keilin (M. D.). **Sur un Nématode nouveau,** *Aproctonema entomophagum,* **n. g. n. sp., Parasite d'une Larve d'un Diptère.** [A new Nematode, *Aproctonema entomophagum*, gen. et sp. n., parasitic in a Dipterous Larva.]—*C. R. Hebdom. Acad. Sciences, Paris*, clxv, no. 12, 17th September 1917, pp. 399-401.

The larvae of *Sciara pullula*, Winn., often contain the female of a Nematode worm full of eggs, the parasite almost completely filling the body-cavity of the larva. One or more males are also present and fertilisation takes place within the body of the host. All the parasitised adults of *Sciara* so far found have been females; those attacked late develop into nymphs and adults. At maturity the female worm ruptures the skin of the host-larva, and escaping into the gallery in the wood made by it, oviposits and dies. When the parasite matures in the adult insect, it escapes by the rupture of an inter-segmental membrane in the abdomen, which often results

in the death of the host. Infestation probably takes place through the skin, because infested larvae bear small scars in the form of black spots.

This Nematode, which is here described under the name *Aproctonema entomophagum*, gen. et sp. n., differs greatly from other species and can be grouped only with aberrant forms such as *Mermis*, *Allactonema*, *Bradynema*, *Atractonema*, and *Sphaerularia*, all of which are parasites in insects.

LOUNSBURY (C. P.). **Division of Entomology: Annual Report 1915–1916.**—*Rept. Union S. Africa Dept. Agric. for Year ended 31st March 1916, Capetown*, 1917, pp. 83–103. [Received 12th October 1917.]

A report for the year ending 31st March 1915 was prepared, but was not published; certain data from that report are included in the present one for purposes of future reference.

Nursery inspection has continued during the year under review, and to those insects already recorded as rendering premises liable to quarantine [see this *Review*, Ser. A, iii, p. 502] the following scale-insects have been added: *Aspidiotus perniciosus*, *A. africanus*, *Chrysomphalus* (*A.*) *dictyospermi*, *Lepidosaphes gloveri*, *Aulacaspis pentagona*, *Parlatoria pergandei*, *Pseudococcus aurilanatus* and *Asterolecanium variolosum*. Regulations governing the introduction of plants and fruits from overseas remain as in the report referred to above, except that the introduction of persimmon stocks has been prohibited and notice is given that, from 1st October 1916, the introduction of apple stocks has ceased. The customary precautions with regard to imported plants, including fumigation or immersion in copper sulphate solution, were carried out with the result that no insects or diseases of any importance were introduced during the year.

The codling moth [*Cydia pomonella*] continues to spread in spite of stringent precautions. The sending of apples, pears and quinces into certain defined areas is prohibited, the attention of the public being drawn to this prohibition by large posters displayed at railway stations. The removal of plants is also governed by regulations and restrictions for the purpose of checking the dissemination of pests, particularly of *Aspidiotus perniciosus*. Any new sugar-cane cuttings introduced are kept in quarantine for a time and are only removed subject to departmental approval.

Migratory locusts were more numerous in the country in 1915–1916 than in any previous year since 1909–1910, the species concerned being the brown locust, *Locusta pardalina* [see this *Review*, Ser. A, iii, p. 719]. The law requires that occupiers of land shall report egg-laying and the appearance of hoppers and that they shall destroy the hoppers, the Government providing the means of destruction. In his 1914–1915 report the author expressed the opinion that a new cycle of locust years had begun. During 1913–1914 an outbreak occurred in one district of the Cape Province and this was evidently the beginning of the cycle. Early in 1915, apparently quite independently of that outbreak, small swarms and numerous solitary locusts were observed in the south-west of the Orange Free State, and it was from this source that the rather severe outbreak of 1915 developed. The

appearance of *L. pardalina* on both these occasions has followed the break-up of a protracted drought, and it seems evident that isolated locusts or unobserved clusters had been continuously present generation after generation and were suddenly able to multiply enormously. It is considered that living eggs may accumulate in the soil during a succession of dry years, and that a protracted drought greatly favours the locusts by relieving them of natural enemies that are relatively slow to respond to the opportunities for increase afforded by a good season following very dry ones. In the case of the 1915 outbreak similar conditions seem to have occurred. Swarms of locusts invaded the district in March and April 1909 and deposited eggs. In the following spring, the hoppers hatching from these eggs were combated energetically; the few winged forms that developed were largely preyed upon by birds and were thought to have been exterminated before eggs could have been deposited. From April 1909 until November 1914, drought conditions prevailed throughout the district; after the latter date rain set in, causing a luxuriant growth of grass, and plant-feeding insects, including grasshoppers, became increasingly abundant, true locusts appearing about February 1915. Necessary materials for control, including pumps and poisons, were at once distributed and efforts were made to control the hoppers of the second generation. Owing, however, to the absence of swarm formation and the difficulty of locating the locusts in the tall grass, this work was not very successful, and later in the season isolated winged locusts were found occurring over an enormous area, while many small swarms hovered about. Many initial measures were taken to acquaint the public with the danger that threatened and with their obligations in dealing with the pest.

Hatching of the eggs began in September and was very protracted, owing to the rains not reaching all the eggs at once, thus rendering control measures more difficult. The outbreak was not uniform, but was much more intense in a number of districts than had been anticipated. A table is given detailing the locust destruction in various centres during September-December 1915.

The locusts of the first generation that escaped destruction began to reach the winged state during the first week of December and probably were all on the wing by the 24th, when the last known swarms of hoppers were dealt with. The number of winged forms succeeding the hoppers seemed small, about 75 swarms being reported, but small lots and isolated individuals were found to be scattered over a large area. Oviposition by the new generation began to be observed in early January, and before the end of the month new hatchings were reported. Until the end of April swarms of hoppers appeared sporadically over the infested area, extending north-west and south-west over new country. These new locusts were in part the progeny of the earlier ones, but in part from eggs that had certainly been in the ground for six months or longer. The swarms were much less numerous than in the earlier outbreak and few were really large, but they were spread over such an immense area and appeared so irregularly that their suppression entailed considerable difficulty and expense. Methodical farm to farm inspection for locusts over such a vast area, where the average farm is upwards of 10,000 acres in extent and sometimes more than five times as large, is quite impracticable in the

absence of a general outbreak owing to the enormous expense involved, and in the work recorded in this report inspection was confined to localities where the insects were known or at least strongly suspected to occur. A table is given showing the distribution of the pest and the results of the work accomplished from January to May, 1916. In some localities birds alone destroyed many swarms and completed the destruction of others, aided to some extent by parasitic flies. In many other parts birds rendered valuable assistance, but were too few to cope effectively even with the early appearing swarms; a condition perhaps explainable by the scarcity at this period of surface water at which they might drink. The hatchings in these parts however were most numerous in March and April and by then the birds were migrating to northern Africa or Europe.

The methods of destruction employed were those developed in former work in South Africa, depending almost entirely on the use of arsenically poisoned syrup, used either to spray the vegetation or in the preparation of a bait to spread among the insects. The syrup, which was issued free of charge, contained to each gallon, about $3\frac{1}{3}$ lb. arsenite of soda (80 per cent. $As_2 O_2$) and either $\frac{2}{3}$ gal. of crude treacle or $6\frac{2}{3}$ lb. of cheap sugar. Directions for its employment were given at length in a special leaflet. The greatest strength recommended for use either as spray or bait is 1 part of the poison as supplied to 50 parts water. In country of the character of that infested in 1915, baiting is generally preferable to spraying; owing to relative scarcity of water, the favourite basis for bait in this instance was dry horse dung collected in the veld. A warning is issued with the poison recommending simple precautions against stock-poisoning, bait that is left lying about in heaps being highly dangerous. But little damage of importance due to either hoppers or winged insects has been reported; while the damage that has been prevented is probably incalculable. In the author's opinion, the damage done has probably been about one-tenth of what it would have been without the operations of the previous season, and he is convinced that without the work of 1915–1916, South Africa would have experienced in 1916–1917 by far the most serious locust trouble in its history, the greater extent to which crops are now cultivated rendering a widespread visitation relatively more important than in earlier years. Absolute extermination of locust swarms by artificial measures is impossible; in such country as was infested in the present invasion a proportion of the swarms are practically certain to escape detection and there are bound to be numerous survivors from the swarms that the average farmer deals with by poison. It is evident that a cycle of years is at present occurring when the locust naturally tends to multiply prodigiously, and it is as yet too early to state with any certainty that it is practicable to prevent a great wave of the pest from sweeping over the country, but it seems reasonable to suppose that the work already accomplished has greatly reduced the potential volume of the threatening invasion. It is conjectured that it is largely an increase in bird and insect enemies that causes in time the temporary disappearance of the pest and it is presumed that, while the development of the outbreak is being retarded by methods of destruction, birds and other enemies are increasing. Conditions favourable to the pest doubtless operate in extensive tracts of desert country where destruction measures are

utterly impracticable, and it is possible that vast swarms developing there in the present cycle may sweep far down into the Union of South Africa; but it seems not unlikely that the infestation of the desert is largely dependent on swarms that migrate there from settled parts and that in combating the pest in cultivated regions the danger of invasion from the desert is greatly minimised. In all, 28,000 swarms were destroyed over an area of 20,000 odd square miles in the present campaign; some 10,000 gallons of poison and 3,556 spray pumps were issued, the total cost of the campaign amounting to about £10,000.

Cyrtacanthacris septemfasciata (red locust) is another migratory species that is liable to cause devastation in South Africa, and though this species has not given any trouble in the Union for a number of years, it is a significant fact that twice before in the last century invasions of the red locust followed close upon those of the brown, the one chiefly devastating the coastal belt and the other the interior; it is therefore rather to be expected that the red locust will soon again give trouble.

Phylloxera has been introduced on Cape grafted vines and has evidently been present for six years or more. It occurs in a number of widely separated districts, but is of so little importance that its extermination is not considered worth attempting. The eucalyptus borer is another introduced insect that is likely at any time to become prominent. Until recently this Longicorn beetle was erroneously known in South Africa as *Phoracantha recurva*, Newm., its correct name being *P. semipunctata*, F. Sickly trees, or those that have been felled and left lying with the bark on, are attacked between the bark and the sap-wood, the tissues being eaten away for many feet together until the tree may be killed. The eggs of the borer are found to be parasitised in the south-western districts of Cape Colony. In Australia it is known to have a number of larval parasites and their introduction into South Africa has been planned for several years, but has not materialised owing to the War.

The Indian cochineal insect, *Dactylopius* (*Coccus*) *confusus indicus* is eradicating with astonishing rapidity the Monocantha prickly pear [*Opuntia monocantha*], especially in Natal. This species is closely allied to the true cochineal insect, *D. coccus* (*C. cacti*), and still more closely to the Cape species, *D. confusus capensis*, which has infested the prickly pear in South Africa for nearly a hundred years without any injurious effect. A small colony of *D. indicus* was brought to South Africa in 1913 by the Queensland Prickly Pear Commission and already nothing but a few dried stumps remain where there were formerly veritable walls of this plant; this is an extraordinary fact, since both the insect and the plant originally came from South America where it is presumed they must exist together.

The results of investigations into the life-history and habits of several common insect pests, including *Bagrada hilaris*, *Colias electra* and *Plutella maculipennis*, will be published in special reports. A Longicorn, *Phryneta spinator* F. (fig borer) and *Enarmonia batrachopa*, Meyr. (false codling moth) are also being studied. Important work has been done in the study of the scale-insects and the termites of South Africa. It is hoped to facilitate the cyanide fumigation of plants by introducing liquified hydrocyanic acid, which volatilises almost instantaneously when exposed to air, producing gas without

any admixture of injurious acid and in a state that is apparently more effective than gas generated in the ordinary way. This liquid is to be produced commercially.

Studies on insects injurious to wattle, the chief of which is the wattle bagworm [*Chalioides junodi*], have been continued. It is hoped that dust-spraying with an arsenical powder will prove an efficient remedy for the bagworm, but further tests are necessary. Experiments to determine the practicability of trapping the male moths are also projected.

Gibson (A.). **Reports on Insects of the Year ; Division no. 1, Ottawa District.**—*47th Ann. Rept. Entom. Soc. Ontario for 1916, Toronto,* 1917, pp. 15–17. [Received 12th October 1917.]

The injurious insects reported during the year included locusts, which disappeared suddenly, owing to adverse weather conditions; cutworms, especially the red-backed cutworm (*Euxoa ochrogaster*, Gn.) attacking cucumbers, beans, peas and other vegetables ; the cabbage maggot (*Chortophila* (*Phorbia*) *brassicae*, Bch.) ; the onion maggot (*Hylemyia antiqua*, Mg.) ; the potato flea-beetle (*Epitrix cucumeris* Harr.), injuring the leaves of tomato ; the corn ear worm (*Heliothis obsoleta*, F.) ; the Scolytid, *Ips fasciatus*, Oliv., present in a few ears of maize, an injury not previously reported in Canada ; the salt marsh caterpillar (*Estigmene* (*Diacrisia*) *acraea*, Dru.) on cabbages ; the parsnip web worm (*Depressaria heracleana*, De G.) ; the zebra caterpillar (*Ceramica picta*, Harr.) damaging turnips, mangels, cabbages and rhubarb ; the ash-gray blister beetle (*Macrobasis unicolor*, Kby.) defoliating potatoes unless they were protected by dusting with arsenate of lead.

Fruit and forest tree pests reported were the pear-leaf blister mite (*Eriophyes pyri*, Pag.) on apple foliage ; the black walnut caterpillar (*Datana integerrima*, G. & R.), usually abundant on walnut and hickory ; the oyster-shell scale (*Lepidosaphes ulmi*, L.) ; the imported currant worm (*Pteronus ribesii*, Scop.) ; and the codling moth (*Cydia pomonella*, L.).

In gardens the tarnished plant bug (*Lygus pratensis*, L.) destroyed large numbers of zinnias and dahlias ; no satisfactory remedy is known for the control of this pest ; the yellow woolly bear (*Diacrisia virginica*, F.) injured hydrangea foliage. The common carpenter ant (*Camponotus pennsylvanicus*, De G.), the shed-builder ant (*Cremastogaster lineolata*, Say) and the cockroach, *Ectobia* (*Blattella*) *germanica*, L., were controlled in houses by dusting with sodium fluoride.

The buffalo carpet beetle (*Anthrenus scrophulariae*, L.), the black carpet beetle (*Attagenus piccus*, Oliv.), the Indian meal moth (*Plodia interpunctella*, Hbn.), attacking breakfast cereals, and the confused flour beetle (*Tribolium confusum*, Duv.), infesting flour, were also reported.

Cosens (A.). **Reports on Insects of the Year : Division no. 3, Toronto District.**—*47th Ann. Rept. Entom. Soc. Ontario for 1916, Toronto,* 1917, pp. 18–19. [Received 12th October 1917.]

Injurious insects recorded include the zebra caterpillar (*Mamestra picta*), causing extensive damage to turnip crops ; *Phyllorycter*

(*Lithocolletis*) *fragilella*, Frey & Boll.,. seriously injuring cultivated honeysuckles; and a new sawfly, *Pontania petiolaridis*, Rohw., closely allied to *P. pisum*, forming galls on the leaves of *Salix petiolaris*.

MORRIS (F. J. A.). **Reports on Insects of the Year; Division no. 5, Port Hope District.**—*47th Ann. Rept. Entom. Soc. Ontario for 1916, Toronto*, 1917, pp. 20–23. [Received 12th October 1917.]

The few insects of economic importance recorded during the season included a weevil boring in willows, American aspen (*Populus tremuloides*), and balm of gilead [*P. balsamifera*]. Aphids severely infested the foliage of elm, poplar and maple, and grasshoppers were very destructive in late summer. Notes on a number of Longicorn beetles are also given.

NOBLE (J. W.). **Reports on Insects of the Year; Division no. 6, Essex District.**—*47th Ann. Rept. Entom. Soc. Ontario for 1916, Toronto*, 1917, pp. 24–25. [Received 12th October 1917.]

Insects pests recorded include wireworms and white grubs doing considerable damage to maize and other cereals, sugar beet and onions; the strawberry sawfly (*Empria ignota*), controlled in two fields by spraying with hellebore; the melon aphis (*Aphis gossypii*), which caused a loss to melon growers of £3,000 and did much damage to cucumbers; the cabbage root maggot (*Chortophila* (*Pegomyia*) *brassicae*); the onion root maggot, *Hylemyia antiqua* (*P. ceparum*); the onion thrips (*Thrips tabaci*); the tobacco worm (*Protoparce* (*Phlegethontius*) *quinquemaculatus*), controlled by ducks and by poisoned bait-plants of *Datura stramonium*.

Insects attacking fruit-trees were :—Codling moth (*Cydia pomonella*); plum curculio (*Conotrachelus nenuphar*); San José scale (*Aspidiotus perniciosus*); tent caterpillars (*Malacosoma americana* and *M. disstria*); the cherry fruit-fly (*Rhagoletis cingulata*); and the lesser peach-tree borer (*Aegeria pictipes*).

The chief greenhouse pests have been Aphids and whiteflies, successfully checked with nicofume, Blackleaf 40, and hydrocyanic gas, and the cucumber beetle [*Diabrotica*], the control of which is best effected by hand-picking.

ROSS (W. A.). **Reports on Insects of the Year; Division no. 7, Niagara District.**—*47th Ann. Rept. Entom. Soc. Ontario for 1916, Toronto*, 1917, pp. 25–28, 1 fig. [Received 12th October 1917.]

Orchard pests recorded were *Cydia pomonella* (codling moth); *Conotrachelus nenuphar* (plum curculio); *Aphis pomi* (apple Aphis), preyed upon by a Cecidomyiid maggot, *Aphidoletes meridionalis*, Felt, and by the Coccinellids, *Hippodamia convergens* and *Coccinella novemnotata*; *Aspidiotus perniciosus* (San José scale); *Psylla pyricola* (pear psylla); and *Paratetranychus* (*Tetranychus*) *pilosus* (imported spider mite), which was readily controlled by lime-sulphur wash.

Other injurious insects were : *Fenusa* (*Metallus*) *rubi* (blackberry leaf-miner), against which no satisfactory remedial method has yet been discovered; *Monophadnus rubi* (raspberry sawfly); *Aegeria tipuliformis* (imported currant borer); *Datana integerrima* (black walnut caterpillar); *Hyphantria cunea* (fall web-worm) on shade and fruit

trees; *Chalepus rubra* (bass-wood leaf-miner) on linden; *Thrips tabaci* (onion thrips) effectively checked by a predaceous bug, *Triphleps tristicolor*; *Aeolothrips fasciatus*; *Leptinotarsa decemlineata* (potato beetle); and *Bryobia pratensis* (clover mite).

Fyles (T. W.). **The Naturalist in the City.**—*47th Ann. Rept. Entom. Soc. Ontario for 1916, Toronto*, 1917, pp. 28–31. [Received 12th October 1917.]

Injury to a branch of red maple by the sawfly, *Tremex columba*, L., is recorded, resulting in the limb snapping off at the point attached. A spruce of fifteen inches diameter at the base, broke off short owing to having been pierced in every direction by the mines of the Longicorn, *Monochamus* (*Monohammus*) *scutellatus*, Say.

Caesar (L.). **Dusting Fruit Trees and Grapes for the Control of Diseases and Biting Insects.**—*47th Ann. Rept. Entom. Soc. Ontario for 1916, Toronto*, 1917, pp. 31–43, 2 figs. [Received 12th October 1917.]

Further tests with dust sprays have been carried out in districts heavily infested with codling moth [*Cydia pomonella*]. The dust used was a mixture of very finely ground sulphur (85 per cent.) and arsenate of lead powder (15 per cent.); in cases where biting insects were absent, as on grapes, the lead arsenate was omitted. Some operators used sulphur mixed with finely ground limestone. The powder was applied by means of a $2\frac{1}{2}$ horse-power gasoline engine, through a 6 ft. length of three-inch rubber tubing, the hopper containing about 100 lb. dust. Dusting may be done with safety either when the foliage is dry or moist, but should be done on a calm day to prevent waste; if there is any wind, spraying should be at right angles to its direction.

The advantages of the dusting method are its quickness and, at the hands of a skilful operator, its cheapness for treating large trees, though in the case of small trees liquid spraying with lime-sulphur and arsenate of lead costs less.

The results showed that the method will control codling moth satisfactorily, but its great drawback is that there has not yet been found a really satisfactory powder for controlling scales or other sucking insects. Finely ground soluble-sulphur mixed with hydrated lime gave fairly good results against San José scale [*Aspidiotus perniciosus*], but was unsatisfactory in practice, owing to its absorbing moisture and hardening, thus clogging the spray machine. Another defect is that the dust does not adhere to glossy fruits and foliage as well as lime-sulphur solution. This method should however prove advantageous in the control of the elm-leaf beetle [*Galerucella luteola*], the tussock moth [*Hemerocampa*], tent caterpillar [*Malacosoma*] and many other biting insects, as well as leaf diseases on shade trees.

Ross (W. A.). **General Notes on Aphides which occur on Apple Trees.**—*47th Ann. Rept. Entom. Soc. Ontario for 1916, Toronto, 1917*, pp. 43–49. [Received 12th October 1917.]

This paper gives brief notes on ten species of Aphids that have been taken on the apple in Ontario. Four of these: *Aphis pomi*

(green apple aphis), *A. malifoliae* (rosy apple aphis), *A. avenae* (oat aphis) and *Eriosoma lanigerum* (woolly aphis), are noxious ; the remaining six, *A. bakeri* (clover aphis), *A. brevis* (long-beaked clover aphis), *A.* sp. near *gossypii*, *Macrosiphum solanifolii* (potato aphis), *Myzus persicae* (peach aphis) and ? *Macrosiphum pelargonii* (geranium aphis), are believed to be of little or no economic importance.

It is pointed out that the correct name for the rosy apple aphis is *A. malifoliae*, Fitch [see this *Review*, Ser. A, v, p. 49].

In the discussion that followed Prof. Brittain stated that there are never more than 8 or 9 generations of *A. pomi* in Nova Scotia, while in Ontario there are 13 or 14 a year. *A. malifoliae* also has 8 or 9 generations a year in Nova Scotia, the greater number of the third generation being migrants. In studying the natural control of these Aphids it has been found that they are preyed upon by the Elaterid beetle, *Sericus* (*Dolopius*) *lateralis*. Prof. Parrott stated that good results in spraying for *A. sorbi*, *A. avenae* and *A. pomi* could be obtained by using a combination spray to combat the San José scale (*Aspidiotus perniciosus*), which is present in nearly all the chief fruit-growing parts of New York, as well as apple scab and the rosy aphis. The mixture is composed of lime-sulphur solution, using the stock material at the rate of 1 to 7 or 1 to 8 of water, with $\frac{3}{4}$ pint of nicotine sulphate added to 100 U.S. gals. of the lime sulphur.

The author further stated that the winged forms of *A. malifoliae* that migrate from apple to plantain are viviparous, as also are the return migrants, though the sexual females which arise from the latter are oviparous. He was unable to say whether this migration was necessary to the species or whether it stimulated sexual development, since under experimental conditions this species had been induced to complete its cycle on the apple, while *A. avenae*, in which the migratory instinct was more strongly developed, could not be induced to remain on apple.

Baird (A. B.). **An Historical Account of the Forest Tent Caterpillar and of the Fall Webworm in North America.**—*47th Ann. Rept. Entom. Soc. Ontario for 1916, Toronto,* 1917, pp. 73–87, 1 map, 6 charts. [Received 12th October 1917.]

This paper reviews the occurrence, local ravages and general outbreaks of *Malacosoma disstria* (forest tent caterpillar) and *Hyphantria cunea* (fall webworm) respectively in the eastern, central and western regions of N. America from the year 1770 to the present day.

Swaine (J. M.). **Some Features of Interest in Connection with our Studies of Forest and Shade Tree Insects.**—*47th Ann. Rept. Entom. Soc. Ontario for 1916, Toronto,* 1917, pp. 95–106, 3 plates. [Received 12th October 1917.]

There is apparently little hope of obtaining an effective control for *Trachykele* sp. (the western cedar borer), an insect that breeds freely in the heart-wood of living forest trees, although burning the slash from infested trees before the early spring should materially reduce its numbers. *Galerucella decora* (willow leaf beetle) usually feeds on willows and poplars, and spraying with strong kerosene emulsion will

prevent serious defoliation. The larvae of *Monochamus* (*Monohammus*) *notatus* and *M. scutellatus* attack white and red pine logs, while the latter also injures spruce logs, but these injuries can be avoided by floating the logs in a loose boom or turning them about a month after they have been floated. Barking the logs or covering them with brush effectively prevents the attacks of borers.

The sawfly, *Kaliosysphinga dohrni* (imported alder leaf-miner), has been recorded from European alder at Ottawa under the name *Fenusa varipes*, Lep. The larvae excavate mines beneath the upper epidermis of the leaves, thus killing them. The larvae drop to the ground and spin a thin silken cocoon slightly below the surface, the pupal period of the summer brood lasting for about two weeks. There are three generations, the last spinning the over-wintering cocoons. They may be killed in their mines, while small, by strong contact insecticides; kerosene emulsion, 1 part stock to 5 parts water, killed 94 per cent. when applied to foliage containing larvae of all sizes. A still better spray is Blackleaf 40, 1 part to 100 gals. water, with 5 lb. soap; this killed all the larvae in the foliage sprayed.

Cyllene robiniae, Forst. (locust borer) can be controlled by cutting out the infested, dying and useless wood as early as possible and burning it before the middle of July. The hibernating larvae beneath the corky outer bark can be killed by spraying the trunks and branches between October and March with kerosene emulsion, 1 part stock solution to 2 parts water.

The Buprestid, *Agrilus anxius*, Gory (bronze birch borer) has been so injurious to cultivated birches that it is feared that the planting of white birches in infested localities will eventually prove useless. The only safe method of control is the cutting and burning of the entire tree before the middle of May. The larvae were found to be very heavily parasitised in 1916, which probably accounts for the small number of beetles found and for the fact that birches have been dying more slowly during the last few years than heretofore.

CAESAR (L.). **Notes on Some Insects of the Season.**—*47th Ann. Rept. Entom. Soc. Ontario for 1916, Toronto,* 1917, pp. 106–110, 1 fig. [Received 12th October 1917.]

Hypsopygia (*Pyralis*) *costalis* (clover hay moth) was reported in large numbers in pea straw that had been stored for two or more years, in which it was associated with *Pyralis farinalis* (meal snout-moth). *Rhyacionia* (*Evetria*) *albicapitana*, Busck, was found attacking *Pinus banksiana* (*divaricata*) (Jack pine) by feeding on the young shoots, without however causing their death. *Cacoecia rosaceana* (oblique-banded leaf-roller), the female of which lays over 300 eggs, was found to be partly single-brooded and partly double-brooded. The larvae from eggs laid in June and early July skeletonise the foliage and some, while not further advanced than the second instar, spin small silken hibernacula, while others become adults that lay eggs in the bark in autumn which remain dormant till the spring. The Buprestid, *Agrilus ruficollis*, damaged about 25 per cent. of raspberry canes in a plantation, but as this beetle is peculiarly local it can be controlled by cutting down and promptly burning infested canes. *Heterocordylus malinus* and *Lygidea mendax* (red bugs) on apple trees can be controlled

by combining tobacco extract with the codling moth spray and applying it just after the blossoms fall. Another Capsid bug, *Neurocolpus nubilus* was satisfactorily checked by spraying with a solution of 1 lb. Sunlight soap to 10 gals. rain-water.

Other pests destructive locally were *Aphis gossypii* (melon aphis), *Chortophila* (*Pegomyia*) *vicina* (beet leaf-miner), *C.* (*P.*) *fusiceps* (corn seed-maggot), *Ceramica* (*Mamestra*) *picta* (zebra caterpillar), *Eulia juglandana* (hickory leaf-roller), *Malacosoma americana* (American tent-caterpillar) and *Fenusa* (*Metallus*) *bethunei* (blackberry leaf-miner).

GIBSON (A.). **Three Important Greenhouse Pests recently introduced into Canada.**—*47th Ann. Rept. Entom. Soc. Ontario for 1916, Toronto,* 1917, pp. 111–122, 2 plates. [Received 12th October 1917.]

The Noctuid, *Eriopus floridensis*, Gn., was first recorded as an economic pest in 1908, when it damaged greenhouse ferns in the United States to the extent of £800. Its first appearance in Canada was in 1915. The caterpillars being very active feeders, soon strip fern fronds and even eat into the more tender parts of the stems. A successful remedy has been spraying with a solution composed of fresh pyrethrum insect powder 1 oz., common laundry soap ½ oz., and water 1 gal., applied once a week for 5 or 6 weeks. Satisfactory results were also obtained by applying dry pyrethrum powder by means of a bellows. Fumigation with tobacco smoke, using 2 lb. tobacco stems to 16,000 cubic ft., and handpicking were partly successful, but spraying with arsenate of lead was not so, a white deposit remaining that was difficult to remove.

Diarthronomyia hypogaea, Lw. (chrysanthemum midge) is a widely distributed pest in N. America and has also been recorded from central and southern Europe. It injures the plants by causing galls and malformations of the stem. It is held in check by fumigating the greenhouse with hydrocyanic acid gas about once a month, which destroys the adults. The cuttings, when potted, should be dipped in nicotine solution, ¾ oz. to 1 gal. water, and during July and August the plants should be sprayed with the same solution every three weeks. The house must be subsequently fumigated with tobacco every ten days.

Neocerata (*Dasyneura*) *rhodophaga.*, Coq. (rose midge) was first recorded in America in 1886, and in Canada in 1914, and is one of the worst pests of roses. Measures recommended against it are the growing of another crop, such as carnations, for one year, and the thorough cleaning of the house in midwinter while the insects are dormant in the soil; this entails the removal and destruction of the plants, the removal and deep burial at a distance of the soil in which they have been grown, and the spraying of the floors and benches with kerosene emulsion.

KINGSMILL (G. F.). **Sweetened Poison Mixtures.**—*47th Ann. Rept. Beekeepers' Assoc. Prov. Ontario 1916, Toronto,* 1917, pp. 61–62. [Received 12th October 1917.]

The serious outbreaks of cutworms and grasshoppers during 1915 having necessitated the use of sweetened poison-baits, the question

arose whether bees would be attracted to, and injured by them. To settle this point, experiments were conducted in the autumn, when frost had stopped the supply of honey. The poison mixture used was composed of bran 20 lb., Paris green 1 lb., molasses $\frac{1}{2}$ gal., water about 2 gals., and 2 or 3 lemons. This was scattered about in the apiary when the bees were flying freely, but only a few, 12 in 40 minutes, visited it, and these did not suffer from any ill effects. A similar mixture, used especially against cutworms, and composed of bran $2\frac{1}{2}$ lb., sugar 1 cup, water 1 qt. and half a lemon, was scattered about the apiary, but was not visited by the bees at all.

Higgins (J. E.). **The Litchi in Hawaii.**—*Hawaii Agric. Expt. Sta., Washington, D.C.*, Bull. no. 44, 27th July 1917, 21 pp., 5 plates. [Received 13th October 1917.]

The litchi [*Litchi chinensis*] is a tropical or subtropical fruit that is just beginning to attract commercial attention outside of China, its native country, where it has been cultivated for centuries. Most of the insect pests attacking this plant are of minor importance, the chief being the litchi fruit worm, the larva of a Tortricid moth, *Cryptophlebia illepida*, Butl., which at times causes considerable damage to the fruit crop. A root-infesting mealy bug, apparently a species of *Pseudococcus*, often attacks the callus formed where a layered branch has been girdled to cause the formation of roots. These scales should be destroyed by some contact poison after the soil has been removed, or by a small amount of carbon bisulphide placed in the soil at some distance from the callus. *Saissetia hemisphaerica* sometimes infests weakly trees, but is easily controlled by oil emulsions. The Japanese beetle, *Adoretus tenuimaculatus*, may attack very young trees, which can be protected by spraying with arsenate of lead. The larvae of the moth, *Tortrix* (*Archips*) *postvittana*, may cause injury to the foliage and flowers, but can be controlled by spraying with arsenate of lead paste containing 15 to 16 per cent. of arsenic oxide and used in the proportion of 8 lb. to 100 U.S. gals. water.

A mite, apparently an undescribed species of *Eriophyes*, causes a disease similar to the erinosis of grapes, but can be practically eradicated by spraying with a solution of 10 oz. nicotine sulphate and $1\frac{3}{4}$ lb. whale-oil soap in 50 U.S. gals. water. The injury begins as small galls or wart-like swellings on the upper surface of the leaf, there being corresponding depressions on the under-surface with a brown, velvety appearance.

***Phylloxera* and American Vine Stocks. The Arguments for and against the Establishment of a Nursery for *Phylloxera*-resistant Stocks in South Australia.**—*Jl. Dept. Agric. S. Australia, Adelaide,* xx, no. 12, July 1917, pp. 963–969. [Received 16th October 1917.]

A Conference of a branch of the S. Australian Agricultural Bureau has discussed a motion for the protection of South Australian vineyards against a possible invasion of *Phylloxera* by the introduction of sufficient resistant stock to establish a nursery adequate for the reconstruction of the vineyards in the event of *Phylloxera* infestation. It was pointed out that when *Phylloxera* was spreading rapidly throughout Victoria sixteen years ago and Mildura was to be linked by rail

with outside parts, the Horticultural Society there decided to establish a nursery of resistant American vine stocks. This was done, and after 15 years experience with American vines Mildura was still free from the pest. As, however, American vines are far less adaptable to variations in soil than the European varieties, experimental stations should be established in the vine-growing districts of South Australia.

It is argued against the introduction of resistant stock that, if future preventive measures are as successful as they have been in the past, there would be no necessity for any change, while the reconstruction of vineyards is a last resource, not to be adopted until all other methods have been exhausted. With regard to the former point, it was contended that the eradication of *Phylloxera*, once this pest has arrived, has failed in every country, resistant stock giving the only permanent immunity. Of 6,000 methods suggested to the French Government as effective means of coping with the pest, only four give any promise of practical value. These are submersion, planting in sand, the use of insecticides and the reconstruction of vineyards on American stocks. The first two were found to have only a very limited value. The use of sulpho-carbonate of potassium or annual injections of carbon bisulphide into the earth, were found to check infestation, immense sums having been spent on these methods. In France, after a period of great decrease in production, it was recognised that reconstruction of the vines was the only solution of the problem.

The Director of Agriculture, in reply to these arguments, pointed out that in France the introduction of American vines had doubled the expenses of the grower, and, if this method were adopted, it would be the first time that any country had introduced the remedy before the disease was present. He also indicated the danger from downy mildew, which had broken out in Victoria where American stock had been imported. He considered that in South Australia, with its isolated vineyards, so different from those of Europe, it should be possible successfully to combat the pest; in his opinion the repressive measures undertaken in Victoria had been altogether inadequate and carelessly executed, hence the necessity for resorting to the introduction of American stock. The probable cost of eradication methods did not seem prohibitive in view of the value of the South Australian vineyards.

After further discussion, the notion was put to the meeting and was declared lost.

Grain Weevils: a Menace to the Wheat Stacks.—*Jl. Dept. Agric. S. Australia, Adelaide,* xx, no. 12, July 1917, pp. 977–979. [Received 16th October 1917.]

This paper contains extracts from the first report of the Special Committee appointed by the Commonwealth Advisory Council of Science and Industry to enquire into the possibility of preventing heavy losses of stored wheat owing to the depredations of grain weevils. This first report deals entirely with the weevils *Calandra granaria* and *C. oryzae*, which are the only insects in Australia attacking stored grain and causing depredations serious enough to demand special measures. The manner of infestation, which must occur after the grain is bagged, is discussed, the possibilities being that weevils

existed in the bags or storehouses used, that adults flying from other centres of infestation work their way into the bags, that infested material may be used to protect wheat stacks, or that infested wheat may be brought into contact with, or stacked near sound grain. Treatment by poisonous gases is not considered practicable for bagged grain, as the cost is prohibitive. Carbon bisulphide was found to be expensive in use, while hydrocyanic acid gas used under similar conditions, *i.e.*, with a temperature of 70°F., was found unsatisfactory even after 48 hours' fumigation. Carbon dioxide was considered the most effective for fumigation, 14·35 cubic ft. of gas being forced in at the bottom of an air-tight silo containing 1 ton of grain. Drying the wheat artificially or in the sun and then storing in air-tight bins is considered sufficient to prevent weevil attack. Excessive moisture, or a temperature of 80° F. without moisture, is fatal to the weevils.

Since fumigation in the case of bagged wheat is so costly, obvious precautionary measures are to prevent the weevil from gaining access to the grain, by avoiding the possibilities of infection detailed above; such precautions however are difficult to carry out in practice. Temperature and moisture are the primary considerations; 10 per cent. of moisture is essential to enable the weevils to breed and when the wheat is put into bags it does not, under ordinary circumstances, contain nearly this amount of moisture, so that unless moisture is added from without the grain will remain weevil proof. If stored in a dry climate therefore and kept completely protected from weather and from the absorption of moisture from the soil, the grain can be stored indefinitely without danger from weevils. The prevailing methods of transport and storage in Australia are apparently very defective, especially as regards grain stored on the seaboard, where the natural moistening of the grain by the damp air penetrating the mass of bags is greatly accelerated by the methods of storage, as these do not by any means afford complete protection from heavy rains.

Reports of Bureau Meetings.—*Jl. Dept. Agric., S. Australia, Adelaide*, xx, no. 12, July 1917, pp. 1009–1014. [Received 16th October 1917.]

The most serious insect pest of citrus trees in Pompoota, S. Australia, is the red scale of the orange, *Chrysomphalus* (*Aspidiotus*) *aurantii*. Fumigation with hydrocyanic acid gas under gas-tight tents during the winter months when the scale is dormant has proved the most successful treatment. The quantity recommended is 1 oz. cyanide of potassium 98 per cent., 1oz. sulphuric acid and 3 oz. soft water, to 150 cubic ft, 45 minutes being allowed for the process. Spraying with red oil emulsion has been used on some plantations with success, and should further experiments prove that this method is efficacious, the work of combating the pest will be light and easy. *Saissetia* (*Lecanium*) *oleae* (black scale) is effectively dealt with by red oil emulsion, the foliage being thinned before spraying. The weevil, *Otiorrhynchus cribricollis*, does considerable damage to young trees of all kinds. As the adults hide during the day, generally just under the surface of the soil, a bandage placed around the stem of the tree

will trap many of them. Young cherry trees that had been badly defoliated by them were sprayed with 1 lb. arsenate of lead dissolved in 6 gals. water. The trees and ground were made white by the mixture and next day hundreds of the beetles were lying dead under the trees.

From Ramco the peach aphis [*Myzus persicae* ?] is recorded as doing considerable damage to peaches and nectarines, necessitating spraying every other day to keep it in check. A contact spray, made by boiling 4 oz. tobacco and $\frac{1}{2}$ lb. soap in 4 gals. water, is recommended. Winter treatment of the soil about the roots is no longer advocated as it is not now thought that this aphis winters in the soil, though winter sprays of 1 oz. soap boiled in 1 pint water, added to 1 quart kerosene, to make an emulsion are recommended. This could be used in the proportion of 1 part emulsion to 9 parts water when the trees are bare, and acts rapidly, but after the trees are in leaf, it must be much more diluted or the foliage will be scorched.

MISRA (C. S.). **The Indian Sugar-cane Leaf-hopper**, *Pyrilla aberrans*, **Kirby.**—*Memoirs Dept. Agric. in India, Agric. Res. Institute, Pusa*, v, no. 11, Entom. Ser., August 1917, pp. 73–133, 10 plates, 17 figs. [Received 17th October 1917.]

A study of the sugar-cane leaf-hoppers at Pusa has revealed the fact that it is only in occasional years that infestation becomes serious; during the nine years that *Pyrilla* spp. have been under observation, there have been only four bad outbreaks. During the intervening periods the hopper is present, but not in sufficient numbers to cause serious injury, the presence of parasitic enemies and unfavourable climatic conditions being efficient checks to its increase. Three species of leaf-hopper are found infesting the canes, namely, *Pyrilla aberrans*, Kirby, *P. perpusilla*, Walk., and *P. pusana*, Dist. A table is given differentiating these species and their distribution, but the life-histories and habits of all of them are so similar that for economic purposes they may be considered together, *P. aberrans* being the species to which the present paper mainly refers. Sugar-cane is the preferred food-plant, but when occurring abundantly the insects are also found on oats, wheat, Guinea grass, millet and other tall grasses. In 1906, when the infestation was extremely severe, oviposition occurred on bamboos, *Ficus religiosa*, *F. infectoria*, *Andropogon sorghum* (juar), peas, gram and even on stones and rubbish, in fact practically anything that was near the sugar-cane plots, although the insect breeds almost exclusively upon sugar-cane, to which it transfers itself by the beginning of June. Eggs are laid most abundantly from June to August, preferably on the lower surfaces of the leaves, and are covered over with a quantity of the white threads which form the chacteristic anal covering of the female. They hatch in about 14 days, the nymphs remaining clustered near the egg-masses for some time and then becoming active. They prefer to feed on the lower surfaces of leaves, particularly towards the base and near the mid-rib. While feeding, honey-dew is exuded, giving rise to the growth of a black fungus, *Capnodium* sp. It is for the sake of this sugary secretion that the ants, *Prenolepis longicornis*, Latr., *Camponotus compressus*, F., and

Tapinoma melanocephalum, F., and the wasps, *Vespa orientalis*, L., and *V. cincta*, F., are attracted to the infested fields. The spots where the nymphs feed are frequently attacked by fungi, which penetrate into the tissues of the plant, causing decay and death, and even if this does not occur, the formation of saccharine matter in the stems is prevented and the resultant crop is very poor. After passing through five instars, the development of each of which is followed in detail in this paper, the nymph becomes lethargic and finally stationary on the leaf; it then moults for the last time, emerging as an adult. The adults move about actively on the leaf-surfaces and jump from one to another, in this way travelling long distances; they cannot, however, fly far. Females apparently occur in far greater number than males; the proportions have not as yet been discovered, but further investigations will be conducted in this connection. Climatic changes seem to effect a great difference in the numbers of adults; hot winds during April and May reduce the number of hoppers considerably; but if heavy rain accompanied by high winds occurs during that period, the majority of the adults perish. During the latter part of summer and the rains, the complete life-cycle of a hopper averages about 52 days; as the cold weather advances the period lengthens to about 130 days. Oviposition occurs from March to December, the adults from the last eggs laid appearing in the following March; there are from 3 to 4 broods in a year, which overlap, so that nymphs and adults are found throughout the year on the canes. The insect attains its maximum development during July-October, while canes are at their critical time of growth.

Enemies of *P. aberrans* include predators and parasites. The former are not important; *Cremastogaster walshi*, For., carries away some eggs, and spiders do some good by catching the nymphs in their webs. Parasites include three Chalcidids infesting the eggs, two of which have been identified as *Ooencyrtus pyrillae*, Crawf., and *Tetrastichus pyrillae*, Crawf. During 1914 these parasites appeared early in August and reached their maximum development in early November, when practically every egg of *P. aberrans* in the field was parasitised; thereafter both egg-masses and parasites disappeared. A table and a graph show the extent of parasitisation of the egg-masses in 1914. Two species of Dryinids, *Dryinus pyrillae* and *Chlorodryinus pallidus*, parasitise the nymphs to a considerable extent; the former was found mostly on nymphs in the 2nd to 4th instars, from August to November. *C. pallidus* was previously known in Australia and is now recorded from India for the first time, where it occurred in large numbers from early November 1914 to mid-January 1915. At first the nymphs of *P. aberrans* seem almost unaffected by the parasitisation, but before the development of the Dryinid grub is complete the nymphs are stationary on the leaves and they die with the emergence of the grub. *C. pallidus* was observed to be attacked in the pupal stage by two species of hyperparasites. The Stylopid, *Pyrilloxenos compactus*, Pierce, parasitises both nymphs and adults of whichever species of leaf-hopper happens to be most abundant during the year. Nymphs may be observed jumping from plant to plant with as many as seven parasites of both sexes on their bodies. The emergence of the male parasites apparently lacerates the tissues sufficiently to cause the death of the host.

Measures that have been found successful in combating the hoppers in the past and recommendations for future control include the collection of egg-masses from the leaves or rubbish at the time of planting the cane setts; these are easily distinguishable owing to the thread-like white covering, and when collected, should be put in wide-mouthed earthen vessels, the tops of which are tied over with cheese-cloth having meshes sufficiently wide to allow the parasites to escape; such collections should be continued from August to December. During March, April and May, if any nymphs and adults are found on the newly-planted as well as the ratoon canes, they should be bagged with hand-nets or field-bags, several types of which are illustrated. When infestation is particularly severe, the canes should be sprayed; 3 pints of crude oil emulsion to 4 gals. water was found sufficient to prevent the emergence of the nymphs; while ½ pint crude oil emulsion and 1 pint sanitary fluid to 4 gals. water is a good spray for nymphs and adults. A first spraying was given in November and was followed by a second application. The numbers of nymphs and adults were considerably reduced by this method, but the leaves of certain varieties of cane were more or less affected. As leaf-hoppers are found to damage broad-leaved varieties of cane more than the narrow-leaved ones, where cane is to be grown under irrigation for a series of years and where injurious species of *Pyrilla* are abundant, it would be better to give preference to the latter varieties for two consecutive years at least.

SMYTH (E. G.). **The White Grubs injuring Sugar-cane in Porto Rico. I. Life-histories of May-beetles (continued).**—*Jl. Dept. Agric., Porto Rico,* i, no. 3, July 1917, pp. 141–169. [Received 18th October 1917.]

This paper is the second of a series, the first of which has already been dealt with [see this *Review*, Ser. A, v, p. 410]. As a result of investigations into the behaviour of the green muscardine fungus, *Metarrhizium anisopliae*, in its attack on *Lachnosterna* (*Phyllophaga*) *vandinei*, the following conclusions in regard to its effect upon May-beetles have been reached: the fungus appears to be transmissible between adults; in the case of grubs it is evident that infection takes place through the soil; other insects infected with this fungus outside the insectary include *Aphodius* sp., *Canthon* sp., *Strategus titanus*, *Ligyrus tumulosus* and *Phytalus insularis*; the disease alone is sufficient to kill white grubs, though infection is sometimes aggravated by previous attack of the grub by mites or bacterial disease; a rather long period of infection, generally accompanied by lengthening of the instar in which the disease is contracted, usually precedes death. A very high mortality among the grubs in the experimental boxes was apparently caused by a bacterial disease, believed to be identical with *Micrococcus nigrofaciens* [see this *Review*, Ser. A, ii, p. 639]. Only the larval stage is attacked, and while the majority of the grubs in the boxes were infected, none collected out of doors were affected by this disease, although they soon contracted it after being placed in the boxes, owing probably to the character of the soil, the degree of humidity, or the confinement that predisposed them to disease, which was contracted after some mechanical injury. This bacterial disease

can hardly be considered as possessing any great possibilities as a means of artificial control of white-grubs, its action in producing death being slow; whether it ever produces mortality of grubs on a large scale in the open in Porto Rico during periods of heavy rainfall, as it is said to do in some parts of the United States, is a question that requires further investigation. *L. vandinei* has been previously recorded under the name *Lachnosterna grandis* [see this *Review*, Ser. A, iv, p. 365].

Lachnosterna (*Phyllophaga*) *portoricensis* (common white grub), being formerly considered as a variety of *L. vandinei*, has also been previously recorded as *L. grandis* [*loc. cit.*]. It has a life-history very similar to that of *L. vandinei*, the feeding habits and food-plants being almost identical. The latter include banana, coconut, breadfruit, *Bambusa vulgaris* (bamboo), *Theobroma cacao* (cacao), and *Mangifera indica* (mango). Grasses other than sugar-cane are not as a rule attacked and the cane appears only to be damaged when more palatable foliage is not available. The beetle's life above ground is believed to occupy between two and three months under normal conditions, the egg-laying period covering about one month. The insect parasites of this species are identical with those of *P. vandinei*, the Tachinid, *Cryptomeigenia aurifacies*, Walt., being the most useful enemy of the adults, and the wireworm, *Pyrophorus luminosus*, Ill., the most efficient in destroying the larvae. These two parasites have doubtless prevented the white-grub injury on the north and east coasts of the Island from becoming anything like as serious as it has been in some districts where these checks do not occur. The Tachinid, *Eutrixoides jonesi*, Walt., and the Scoliid, *Elis xanthonotus*, may prove to be parasitic on this species of *Lachnosterna*. About 8% of the number of *L. portoricensis* reared in confinement were attacked by the green muscardine fungus, but there is no indication that many deaths result from this disease under normal outdoor conditions.

Other species of *Lachnosterna* that are minor pests of sugar-cane, and of which the life-histories and habits greatly resemble the more important species dealt with, are given in tables and described in detail, including *L. guanicana*, formerly recorded under the name *L. media* [*loc. cit.*], which prefers dry, upland soil and has not yet appeared in the cane-fields to any extent. The favourite food-plants of this species are *Psidium guayava* (guava), *Cordia cylindrostachys* (black sage), *Lantana camara*, and tamarind. *L. citri*, formerly recorded as *L. media* [*loc. cit.*], feeds abundantly upon grape-fruit, orange, guava, and many host-plants common to other species, and the larvae frequently cause considerable injury to young citrus trees. *Phytalus insularis*, formerly recorded as *L. pequena* [*loc. cit.*], has been found feeding upon *Amaranthus* sp. (pig-weed), and various grasses. In experimental cages the adults fed upon maize foliage; no examples were observed feeding upon cane, though they occur plentifully in the cane-fields and doubtless the grubs attack the cane roots.

COTTON (R. T.). **The Egg-plant Lace-bug in Porto Rico: *Corythaica monacha*, Stål.**—*Jl. Dept. Agric., Porto Rico*, i, no. 3, July 1917, pp. 170–173. [Received 18th October 1917.]

The Tingitid, *Corythaica monacha*, Stål, is the most serious of the many pests of the egg-plant, *Solanum melongena*. It is found

throughout Porto Rico, subsisting during the intervals between crops on the wild egg-plant, *S. torvum*. Both nymphs and adults congregate on the under-sides of the leaves and suck the plant juices, eventually causing the leaf to dry and fall.

The insect has a very short life-cycle and multiplies very rapidly, breeding continuously throughout the year. Eggs are laid on the under-sides of the leaves and hatch in about six days; the nymphs develop rapidly, moulting five times before they become adult. Tables showing the length of the various stages are given. The period from the hatching of the egg to the appearance of the adult occupies only ten days. Predaceous insects that feed on the soft-bodied nymphs of the lace-bug include the Coccinellids, *Megilla innotata*, Muls., and *Cycloneda sanguinea*, L., and the Reduviids, *Zelus rubidus*, Lap. & Serv., and *Z. longipes*, L. A spray consisting of 8 lb. soap to 50 U.S.gals. water should be used as soon as possible after the appearance of this pest.

Cotton (R. T.). **Life-History of *Haltica jamaicensis*, Fabr.**—*Jl. Dept. Agric., Porto Rico,* i, no. 3, July 1917, pp. 173–175. [Received 18th October 1917.]

Haltica jamaicensis is the largest of the flea-beetles found in Porto Rico and is at times extremely abundant. It occurs also in Jamaica, Santo Domingo, Haiti, Costa Rica, and Cuba. While the favourite food-plants are the common weeds, *Jussiaea leptocarpa*, *J. suffruticosa* and *J. erecta*, it occasionally feeds on garden beans and might become a serious pest if its usual food-supply should fail. The eggs, which are laid on the leaves and stems of the plant, number about 520 for each female; they hatch in four to six days and the young larvae feed on the foliage, descending to the soil to pupate after the second moult. The prepupal and pupal stages together occupy 11 days, the whole life-cycle requiring 39 days.

Cotton (R. T.). **Scale-feeding Habits of a Porto Rican Millipede: *Rhinocricus arboreus*, Saussure.**—*Jl. Dept. Agric., Porto Rico,* i, no. 3, July 1917, pp. 175–176. [Received 18th October 1917.]

The author records having observed the millipede, *Rhinocricus arboreus*, feeding upon the purple citrus scale, *Lepidosaphes beckii*, which was heavily infesting a grape-fruit tree. Experiments in the laboratory disclosed the fact that as many as 2,000 scales may be devoured in three hours by one millipede, which, after a short rest, is ready to continue feeding. About a dozen individuals were then placed in each of several small grape-fruit trees that were badly infested with purple scale. At the end of two weeks the trees were clear of the scales, and although most of the millipedes left the trees in search of more food, these were still free from scales four or five months later, while similar trees sprayed with oil emulsion were badly re-infested. Although the millipedes are not likely ever to be of any great importance in controlling scale-insects in citrus plantations, it is evident that they are not entirely vegetable-feeding Myriapods, as is generally supposed.

Brown (N. E.). Scale-insects and American Blight on Fruit Trees.—*Gardeners' Chronicle, London,* lxii, no. 1608, 20th October 1917, p. 162.

A severe infestation of an apple tree by brown scale-insects is recorded, the trunk and lower branches being so thickly covered that the individual insects touched one another. Treatment consisted in thoroughly scrubbing the tree from the ground upwards with a very strong mixture of crude Sanitas and water; this was allowed to dry on the tree, which was then thoroughly painted with linseed oil. The insects were exterminated by this means, and the following year the tree increased in vigour, the old bark being thrown off.

Patches of woolly aphis [*Eriosoma lanigerum*] on another tree were destroyed with linseed oil and, though this pest reappeared in subsequent years, a further application of the oil at once controlled it, without in any way injuring the tree.

Dobrovliansky (V. V.). **Списокъ тлей, встрѣчающихся на культурныхъ растеніяхъ въ Харьковской губерніи.** [A List of Aphids found on cultivated Plants in the Government of Kharkov.]—Reprint from **« Бюллетень о вредителяхъ сельскаго хозяйства.»** [*Bulletin on Pests of Agriculture*], *Kharkov,* 1916, 6 pp. [Received 5th October 1917.]

This list has been prepared by the author from a collection of Aphids submitted to him by V. G. Averin of the Kharkov Entomological Bureau; some data on the biology of the individual species are added, partly from the author's own observations.

The following are the species dealt with: *Acyrthosiphon pisi,* Kalt., found on *Medicago sativa,* L. *Macrosiphum rosae,* L., on roses, being the most injurious of all Aphids found on this plant; in the summer it is also found on *Dipsacus silvester, Knautia arvensis* and *Scabiosa columbaria. M. granarium,* Kirby (*Sitobium cerealis,* Kalt.), on rye; there is some conflict of opinion as to the life-history of this species; according to Kollar, the wintering eggs are laid on cereals, and this is confirmed by the observations of the author, who has observed ovipositing females of *M. granarium* on winter wheat in autumn and the stem-mothers in early spring; on the other hand, Börner regards cereals only as intermediate food-plants, the wintering eggs according to him being laid on roses and bramble. *Myzus cerasi,* F. (*aparines,* Kalt.), is, according to the author's observations, only a partially migratory species; in summer it migrates from plums and cherries to *Galium* and *Veronica chamaedrys,* but also continues to breed on its chief host-plants, although to a less extent than in the spring. *Chaitophorus ribis,* L., occurs on red currants; the species found on black currants, which was previously mistaken for this one, has been now identified by Miss Patch as a distinct species, *Myzus dispar,* Patch. *Rhopalosiphum ribis,* Buckt. (*lactucae,* Kalt.), is found on flower-buds of *Lactuca hispida* and on *Sonchus,* these being the intermediate food-plants of this species, the chief being black currant. *Hyalopterus pruni,* F., is found on plums, blackthorn (*Prunus spinosa*) and reeds (*Phragmites communis*), to which last plant this species migrates in summer, though continuing to breed on plums. *Rhopalosiphum nymphaeae,* L.

(*Aphis prunorum*, Dobr.), migrates from plums and apricots to various other plants such as *Nymphaea* and *Alisma*; it is believed that *R.* (*A.*) *infuscata*, Koch, occurring on blackthorn is identical with this species.

A. pomi, De G. (*mali*, F.), attacks apples; *A. grossulariae*, Kalt., on the young shoots of both red and black currant and gooseberries; *A. laburni*, Kalt., occurs on *Robinia pseudacacia*, though it is unknown whether it lives on this tree the whole year or only during the summer months; *A. rumicis*, L., occurs on maize, poppy, beet, *Chenopodium album*, *Atriplex*, *Cirsium*, and *Lappa tomentosa*; *A. brassicae*, L., is said by some authors to occur on beet and spinach, but the correctness of this statement is disputed, *A. rumicis* being evidently in such cases mistaken for it. Davis has lately described a new species, *A. pseudobrassicae* [see this *Review*, Ser. A, ii, p. 604], but the author believes that this is *A. erysimi*, Kalt., which he has found near Kiev on *Brassica rapa*, *Sinapis arvensis*, *Raphanus raphanistrum*, *Erysimum cheiranthoides*, and *Capsella bursa-pastoris*. *A. pyri*, Boy., occurs on apples; the author agrees with Baker [see this *Review*, Ser. A, v, p. 49] in treating this species as distinct from *A. crataegi*, Kalt., which is unable to live on apple; there also occurs on apple trees a species resembling in many respects both *A. pyri* and *A. crataegi* and more especially *A. radicola*, Mordv., on roots of sorrel. *A. cardui*, L. (*pruni*, Koch), occurs on *Lappa minor*; the author has already established the identity of these two forms [see this *Review*, Ser. A, ii, p. 81] and further experiments in 1915 have finally confirmed the fact that *A. cardui* migrates in summer to *Senecio vulgaris* and *Capsella bursa-pastoris*, and that *A. jacobaeae*, Schr., and *A. capsellae*, Koch, hibernating usually on plums, are synonyms of it. *A. cardui* can also winter on some intermediate plants such as *Senecio* and *Carduus*, either as parthenogenetic females or in the egg. Under the name of *A. insititiae*, Koch has described the stem-mother and winged forms of the second generation of *A. cardui*. Börner has recorded the migration of *A. cardui* to various grasses, but the species he was studying was *A. myosotidis*, Koch, which has been observed by the author to migrate from plum to *Myosotis intermedia*, *M. palustris*, *Senecio vulgaris*, *Solidago virga-aurea* and *Erigeron canadense*.

Plotnikov (V.). **Погода и вредители растенiй.** [The Weather and Pests of Plants.]—Published by the Turkestan Entomological Station, *Tashkent*, 1917, 7 pp.

The weather of the spring and summer of 1917, which was characterised by a recurrence of frosts in April and by an intense drought, provides a convincing illustration of the connection existing between meteorological conditions and the nature and numbers of insect pests. The drought especially affected the breeding of *Dociostaurus* (*Stauronotus*) *maroccanus*, the eggs of which require a certain amount of warmth and moisture for their development. Many individuals perished in the eggs, while still in the last embryonic stage; others, although they succeeded in hatching, were unable to leave the egg-clusters; and those locusts that appeared in spite of all these unfavourable conditions perished from the absence of food on the dried-up steppes. The number that reached the winged stage was

very small, and the danger of the large outbreak that was expected did not materialise ; there was consequently no need to utilise the extensive preparations that had been made for the campaign. These causes were also responsible for the decrease in the numbers of *Locusta migratoria* in some places, as well as of some other insects, which, in the absence of locusts, were destroyed by birds to a greater extent than usual.

The drought however favoured the increase of *Tetranychus*, which has done considerable damage to cotton, and of the cabbage and the cotton Aphids [*Aphis brassicae* and *A. gossypii*]. The frost in April destroyed a number of insect pests of orchards, and a considerable reduction in the numbers of *Cydia pomonella*, *C. funebrana*, *Rhynchites auratus* and of *Hypera* (*Phytonomus*) on lucerne is to be expected next year.

Инструкція по борьбѣ съ саранчевыми насѣкомыми въ Туркестанскомъ краѣ на 1917 годъ. [Instructions for combating Locusts in Turkestan in 1917], *Tashkent*, 1917, 11 pp.

These are regulations sanctioned on 15th March 1917 by the Governor-General of Turkestan and deal with the technical conduct of the campaign against locusts in the current year. They define the duties of the officials in charge of the work in various districts and the method of accounting for the funds expended.

Plotnikov (V.). **Наставленіе по борьбѣ съ марокксной кобылкой.** [Directions for the Control of *Dociostaurus maroccanus*.]—Published by the Turkestan Entomological Station, *Tashkent*, 1917, 17 pp., **11 figs.**

This booklet comprises a popular account of the life-history of *Dociostaurus* (*Stauronotus*) *maroccanus*, followed by a description of the remedies used for destroying it. Directions for the preparation of insecticides and the use of sprays and poisoned baits are given. Portable iron sheets are recommended as suitable for dealing with small swarms of hoppers.

Plotnikov (V.). **Наставленіе къ распознаванію массовыхъ саранчевыхъ насѣкомыхъ Туркестана.** [Directions for the Identification of Locusts appearing in large Masses in Turkestan.]—Published by the Turkestan Entomological Station, *Tashkent*, 1917, 27 pp., 37 figs.

This is an edition in book form of a poster previously issued [see this *Review*, Ser. A, ii, p. 614]. In addition to the species already mentioned, data for the identification of *Dociostaurus* (*Stauronotus*) *albicornis*, Ev., *D.* (*S.*) *anatolicus*, Kr., and *D.* (*S.*) *hauensteini*, Kr., are also given.

Archangelsky (P. P.). **Къ біологіи персиковой тли.** [On the Biology of *Pterochloroides persicae*, Chol.]—Published by the Turkestan Entomological Station, *Tashkent*, 1917, 70 pp.

This book is a result of the author's observations during 1916, both in nature and in the laboratory at the Turkestan Entomological Station.

Pterochloroides (*Pterochlorus, Lachnus*) *persicae*, Chol., of which *Dryobius amygdali*, Goot, is a synonym according to Mordwilko, occurs in Transcaucasia and Turkestan and has also been reported from Palestine. In addition to peaches (*Prunus persica*), it occurs on almonds (*Amygdalus communis*), sloes (*Prunus divaricata*), plums (*Prunus domestica*), apricots (*Prunus armeniaca*), quinces (*Cydonia vulgaris*) and apples (*Pyrus malus*). Though it can breed and complete its cycle on peaches, apricots and sloes, on the other plants the colonies die out after a short time. The examples bred on peaches are the largest, those on almonds being the smallest, and those on apricots and plums of an intermediate size.

P. persicae, Chol., winters in the egg-stage, the young appearing early in spring at the end of February or in March according to the conditions. The stem-mothers are very sluggish; they live for 52 days or more and give birth to living larvae, the exact number of which has not been determined. The wingless parthenogenetic females of the next generations resemble the stem-mother, but are of larger size. The number of generations obtained in the laboratory was eleven, but it is thought that more occur in nature. The larvae moult four times, maturing and becoming viviparous a few days after the last moult. Tables are given showing the intervals between the moult of the first and second generations and the duration of the larval period for each generation; the last table shows that the fifth, sixth and seventh generation develop in the shortest time, while the ninth and tenth take the longest; the larval stage is thus shorter in summer and longer in spring and autumn. Other tables deal with the number of larvae born of the wingless parthenogenetic females; this number declines with the age of the mother, being highest in the first half of its life, and with the generations to which the mother belongs; the average figure for the second, third and sixth generations is three larvae per day, for the fourth and eighth, two larvae, and for the seventh and ninth, one larva per day. According to Plotnikov winged parthenogenetic females appear in July, but the author has observed them much earlier, from the middle of May till autumn, their maximum being in July and August. In the year in question, no sexual forms were observed, the hibernating eggs having been laid by the wingless parthenogenetic females; further observations are required to show whether *P. persicae* normally differs in this respect from allied species of Aphids, which usually produce sexual forms in autumn that give rise to the hibernating eggs. Another peculiarity observed in *P. persicae* consists in the ability of the same individual first to give birth to larvae and then to deposit eggs. The oviparous forms practically differ in no way from the wingless females, except for their larger size. The individuals of the last few autumn generations lay eggs, generally in heaps of five or six on the lower sides of the branches.

The colonies of *P. persicae* are usually found on the under-side of stout or medium-sized branches, although they sometimes occur on the smaller ones and in rare cases at the base of the trunk near the ground. Migrations, in which whole colonies frequently participate, occur owing to shortage of food, the movement of the sap in the tree, the attacks of parasites and other enemies, and also from the effect of light, shaded spots being preferred. By means of these movements the Aphids frequently reach other trees, either by way of adjoining

branches or along the ground, while the winged forms are able to fly from tree to tree. The time when these movements start is of great importance as regards their control; they begin with the second generation and increase with the appearance of the next, especially during June and July.

The relations between ants and *P. persicae* are discussed at length in a special chapter. Four species of ants, not identified, were observed amongst the colonies. In several instances ants were seen carrying away wings of this Aphid which they had apparently bitten off. Of the four species observed, at least two play an important part in the life of *P. persicae.* Besides keeping away the parasites from the colonies, which they are able to do only to a limited extent, they gnaw out and remove from the bodies of the infested Aphids the larvae and pupae of the parasites [see this *Review*, Ser. A, iv, pp. 210, 211].

Four species of parasites were observed among the colonies, one being a mite, the other three belonging to the Hymenoptera. Of these, one, having points of resemblance with *Pachyneuron syrphi*, Ratz., and *Encyrtus aphidivorus*, Mayr, is probably a hyperparasite of one of the remaining two species, of which the life-history was not worked out, as it was found only occasionally. The remaining species, apparently belonging to the genus *Aphidius*, mainly oviposits in the younger larvae. This parasite winters in the larval stage inside the dead host and has several generations. Other enemies of this Aphid include: Syrphid larvae, one a species of *Syrphus* and the other a species of *Melithreptus*: and wasps, probably *Psen pallidipes*, Pz., are predaceous on the young larvae. *P. persicae* also suffers from a fungus disease, caused probably by a species of *Capnodium.*

Serious damage from *P. persicae* has been noticed only on peach trees, the other trees on which it is found showing no signs of being affected, whereas on peaches whole branches are frequently killed. The author intends to continue his observations as to the best remedies for this pest and quotes a number of statements on this subject by other observers. Kerosene-lime-emulsion (2–3 lb. of kerosene, $\frac{1}{8}$–$\frac{1}{4}$ lb. of lime in 3 gallons of water), quassia soap emulsion, tobacco emulsion, and smearing with carbolineum, are mentioned as effective remedies.

KRASSILSHTCHIK (I.). **Какъ бороться съ амбарнымъ долгоносикомъ.** [How to control *Calandra granaria*, L.] — **«Земледѣльческая Газета.»** [*Agricultural Gazette*], *Petrograd*, nos. 29 (195) & 30–31 (196–197), 4th & 18th August 1917, pp. 566–568 & 590–591.

Preventive measures, aiming principally at the isolation of clean from infested grain, should be the chief method of checking the damage done by *Calandra granaria.* This weevil is not found either in the field or in the threshing ground, but hides in the store-houses, and if these can be freed from it before the new grain is brought in, no danger of infestation should arise. In the first instance measures must be directed against the original sites of infestation, *i.e.*, in the stores of the peasants in the villages; new grain must be introduced only after these have been thoroughly cleared of the pest, and in cases where their structure does not allow of this, they should not be used for storing grain. The cleaning of the store-houses can be done by mechanical means and by fumigating, for which purpose

sulphur can be used, in the absence of carbon bisulphide. The burning of 500-600 grammes of sulphur for each cubic metre of space for three days is sufficient to destroy the weevils. From the point of view of the ultimate destruction of the pest, the cleaning of the actually infested grain by means of winnowing and fumigation, for which purpose sulphur can also be used, are of less importance than the prevention of the spread of the pest to uninfested grain.

Batalov (S.). **Цвѣтоѣдъ-долгоносикъ и борьба съ нимъ.** [*Anthonomus pomorum* and its Control.] —**«Плодоводство.»** [*Fruit-Growing*], *Petrograd*, xxxviii, no. 1–2, January-February 1917, pp. 44–46. [Received 22nd October 1917.]

This paper describes and figures sheets which have been used with great success against *Anthonomus pomorum*. The usual failure of this method is attributable to the small size of the sheets on to which the weevils are shaken. The author used two sheets for each tree, each being about 4 or 5 yards long and half that width, with a piece cut out at the point where the edge touches the trunk. Still bigger sheets were used for old and large trees. Instead of striking the trunk of the tree with a wooden hammer, which is ineffective and damages the bark, the branches were themselves shaken and the weevils that fell were at once crushed to death. By employing this method during April, it was possible to free the orchard from this pest and no damaged buds were observed during blossoming. Before shaking, it is advisable to spray the trees with water, as this prevents the weevils from escaping by flying.

Sinitzyn (S.). **Состояніе садовъ въ Симбирскѣ.** [The Condition of Orchards in Simbirsk.]—**«Плодоводство.»** [*Fruit-Growing*], *Petrograd*, xxxviii, no. 1–2, January-February, 1917, pp. 64–65. [Received 22nd October 1917.]

At Simbirsk large outbreaks of *Hyponomeuta malinellus* have occurred during the last two years. Spraying with Paris green or with the mixture of arsenic and lime recommended by Rogozin [see this *Review*, Ser. A, iii, p. 21] proved very successful, but was not universally carried out and great loss was suffered by local horticulturists in consequence.

Gomilevsky (V.). **Мучной клещъ** (*Aleurobius farinae* syn. *Acarus farinae*)—**опасный вредитель чернослива и другихъ сушеныхъ плодовъ, и борьба съ нимъ.** [*Tyroglyphus* (*Aleurobius*) *farinae*, a dangerous Pest of dried Plums and other dried Fruits, and its Control.]—**«Плодоводство.»** [*Fruit-Growing*], *Petrograd*, xxxviii, no. 3–5, March-May 1917, pp. 120–127. [Received 22nd October 1917.]

Tyroglyphus (*Aleurobius*) *farinae* is primarily a pest of flour and grain, but it is often found in many other food-stuffs, including all kinds of dried fruits. The white inflorescence frequently present on such fruits is nothing but the bodies of innumerable mites, covered with particles of crystallised sugar. The author gives a short account of the life-history of this mite and discusses the methods of fumigating

against it with carbon bisulphide, hydrocyanic acid and aniline. The latter has many advantages over carbon bisulphide, as it is neither poisonous nor inflammable, but is much more expensive.

Baryshevtzev (V.). **Кедровники-плодовые сады.** [Cedar Plantations for Seed.]—**«Лѣсной Журналъ.»** [*Forestry Journal*]. *Petrograd*, xlvii, no. 1–3, 1917, pp. 35–55, 3 photos. [Received 24th October 1917.]

In this paper on *Pinus cembra* (Siberian Cedar), the chief insect pests of this tree are stated to be *Hylobius abietis* and *Monochamus* (*Monohammus*) *sutor*. The latter attacks trees already injured by *H. abietis* or other beetles and has been reported as doing serious harm in the government of Tobolsk.

Trapping of the Cotton Stainer.—*Agric. News, Barbados*, xvi, no. 400, 25th August 1917, p. 267.

The Agricultural Superintendent, St. Vincent, records the results of experiments recently made to control *Dysdercus delauneyi*, Leth. (cotton-stainer) in the field in St. Vincent. In 1916 a campaign was instituted against the silk-cotton tree [*Eriodendron anfractuosum*], an important food-plant of this pest, though a small number could not be dealt with owing to their being situated among valuable crops. When they fruited, these isolated trees acted as traps and attracted large numbers of cotton-stainers.

In order to trap and destroy the insects, without permitting them to scatter over the district, heaps of silk-cotton pods were made under the trees and three times daily the insects on them were collected and killed with boiling water. As the pods became exhausted, cotton-seed meal was substituted, but this quickly lost its attractiveness, though cotton seed proved a striking success, especially when the traps were shaded. The fear that boiling water, inefficiently applied by labourers in remote districts, might result in the traps actually becoming breeding places, suggested the substitution of kerosene emulsion, but this acted as a repellent, the traps requiring to be freshly baited after each spraying.

All these difficulties have been overcome by the use of the gasoline torch, which has proved expeditious, efficient and inexpensive. The torch used was of American manufacture, costing 15*s.*, and held one quart of gasoline; this gave a long, clear, blue, continuous, horizontal jet of flame that could easily be directed to any required point. Most of the insects were killed in a few minutes, while the attractiveness and effectiveness of the bait was not destroyed, and it could be used for several days in succession if the weather were not very wet, early morning proving the best time to visit the traps.

Ritchie (A. H.). **Scale on Yams.**—*Jl. Jamaica Agric. Soc., Kingston*, xxi, no. 9, September 1917, pp. 358–359.

Targionia hartii, Ckll. (yam scale) is found encrusting the tubers of yams in Jamaica and ascends from the tubers to the plants, which are sometimes killed by this scale. As soon as a crop of infested yams has been gathered and the old vines burnt, the plot should be

abandoned and a fresh one chosen, to windward of the previous patch, if near at hand, as the crawling stages are carried by wind. The heads before planting should be dipped in lime-sulphur solution diluted in the proportion of 1 gal. concentrate (32) to 10 gals. water, the formula used being 4 lb. fresh stone lime, 8 lb. sulphur, 2 gals. water. Kerosene emulsion diluted with 4 parts water to one part emulsion might be substituted. Experiments are needed to determine the exact strength of either lime-sulphur or kerosene emulsion necessary to kill this scale on the growing vines without injury to the foliage. Spraying should, however, be considered as merely supplementary to careful treatment of the heads at the time of planting.

Black Fly.—*Jl. Jamaica Agric. Soc., Kingston,* xxi, no. 9, September 1917, p. 381.

The black fly of citrus trees [*Aleurocanthus woglumi*] causes much damage in Jamaica, and spraying with petroleum emulsion is a tedious and expensive process. It is considered probable that the ant recently discovered as predaceous on the scale [see this *Review*, Ser. A, v, p. 238] will prove to be the best control.

SWAINE (J. H.). **Shade Trees and Forest Insects in Manitoba.**—*Agric. Gaz. Canada, Ottawa,* iv, no. 9, September 1917, pp. 755–763.

This paper contains notes on the shade-tree pests of Manitoba, many of which have been previously dealt with [see this *Review*, Ser. A, iv, p. 249], and gives general directions for spraying, with formulae for the sprays most usually employed.

Destructive insects in the forest area include *Lygaeonematus* (*Nematus*) *erichsoni* (larch sawfly), which, recently introduced from Ontario, is now firmly established in Manitoba and has spread westward into northern Saskatchewan. The larvae are sometimes so numerous as to defoliate the trees. There are several native parasites, but they are seldom able to check the pest before the trees have been seriously injured. Parasites that are an effective check in England have been distributed in Manitoba and it is hoped that they will prove an important means of control. Cultivated larches should be sprayed with lead arsenate or Paris green.

DOANE (R. W.). **Effect of Smelter Gases on Insects.**—*Science, Lancaster, Pa.,* xlvi, no. 1186, 21st September 1917, pp. 295–296.

It has often been asserted that the waste gases, especially sulphur dioxide, evolved during the smelting of copper, lead and other ores, have such an injurious effect on insect life in the vicinity, that even fruit crops have been affected owing to the lack of bees to insure pollination. Experiments to test the truth of this have been conducted during the past three years, and it has been proved conclusively that sulphur dioxide, even at a concentration of 25 parts in a million of air, which is a much higher percentage than that of the gas from the smelters, has no effect whatever on flies, mosquitos, leaf-hoppers, grasshoppers or Coccinellid beetles. Though burning 2 lb. sulphur for every 1,000 c. ft. of space results in a concentration of 24,000 parts of gas to a million of air, prolonged fumigation even at this rate sometimes fails to kill all the insects concerned.

HARTENBOWER (A. C.). **Report of the Agronomist in Charge.**—*Rept. Guam Agric. Expt. Sta., 1916, Washington, D.C.*, 3rd August 1917, pp. 1–40. [Received 5th October 1917.]

The most serious pest of tobacco in Guam is *Heliothis obsoleta* (bollworm), which feeds on the leaves and buds, reducing the yield and the quality of the leaves by perforating them. The experiment of sprinkling the terminal buds and upper leaves once a week during the growth of the crop with a mixture of seven parts maize flour and one part powdered lead arsenate gave good results, the yield of perfect leaves rising from 9 to 12 per cent. in unshaded plants, and from 10 to 29 per cent. in shaded plants.

Radishes were seriously attacked by *Hellula undalis* (cabbage webworm), especially during the dry weather, every planting made from 27th December to 1st April being completely destroyed. Spraying with lead arsenate against this insect proved effective only on fertilised plots.

BORDAS (M. L.). **Ponte du Rhynchite coupe-bourgeon** (*Rhynchites conicus*) **et Anatomie de sa Larve**. [Oviposition of *Rhynchites conicus* and the Anatomy of its Larva.]—*C. R. Hebdom. Acad. Sciences, Paris*, clxv, no. 2, 9th July 1917, pp. 70–73.

Rhynchites conicus is a small weevil that attacks the buds and young shoots of apple, pear, cherry and peach trees, boring a perpendicular gallery below the point of insertion of a leaf or of an axillary bud, and depositing in it two or three eggs. As a result of this injury, the terminal part of the shoot dries up and blackens and the with ered buds, fall. The larvae eat away the medullary and inner cortical region of the bud, which thus becomes easily detached

Gafanhotos no Amazonas. [Locusts in the State of Amazonas.]—*Chacaras e Quintaes, S. Paulo*, xvi, no. 2, August 1917, p. 117, 1 fig.

Schistocerca paranensis, Burm., is recorded for the first time as having caused serious injury at Manaos, which is much farther north than the Brazilian territory hitherto infested by this locust.

Les Ravages des Chenilles de Piérides sur les Crucifères. [The Ravages of *Pieris* caterpillars on Crucifers.]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xvi, no. 9-10, September-October 1917, pp. 108–110.

Pieris brassicae, L., *P. rapae*, L., and *P. napi*, L., have caused great loss to market-gardeners throughout the south-west of France by their attacks on cabbage, kohl-rabi and other Cruciferae. *P. brassicae* was especially abundant in August, and it was feared that these attacks would recur during October when the second brood of larvae hatch. These butterflies have a number of natural enemies, including various birds, a Tachinid fly, *Exorista vulgaris*, Fall., a Chalcidid, *Pteromalus puparum*, L., and a Braconid, *Apanteles* (*Microgaster*) *glomeratus*, L. A bug, *Nabis lativentris*, devours the eggs and larvae. The usual control measures, including hand-picking and crushing the eggs and caterpillars, arsenical, nicotine and pyrethrum sprays and powder-sprays

of lime or superphosphate, are recommended. The American method of destroying all the cabbage stalks after the crop is gathered, with the exception of a few plants, on which all the eggs of the next generation will be deposited, is recommended; these can then be treated with arsenic or some other insecticide before a fresh crop is planted. Water heated to 120° or 130° F. is known to kill the majority of the caterpillars without injuring the plant. The same methods can be applied against the caterpillars of the Noctuids, *Barathra* (*Mamestra*) *brassicae* and *Polia* (*M.*) *oleracea*, which have been causing similar damage. The adults of these moths can be caught by lantern-traps.

LESNE (P.). **Les Piérides : Leur Destruction en Hiver.** [The Destruction of *Pieris* in Winter.]—*Jl. D'Agric. Pratique, Paris*, **xxx**, no. 21, 18th October 1917, pp. 410–411.

Against the caterpillars of *Pieris*, which caused great destruction to cabbages during the season of 1917, if it is not possible to crush the eggs by hand, a spray of soapy water in $2\frac{1}{2}$% strength has been found useful, or a mixture of 4 lb. of black soap and 3 lb. turpentine to 20 gals. of water may be used. When the caterpillars have left the vegetation and climbed up trees, walls, etc., to pupate, they may be collected by hand. The cocoons of the Braconid parasite, *Apanteles glomeratus*, should of course be left.

VAN DER GOOT (P.). **De Zwarte Cacao-Mier** (*Dolichoderus bituberculatus*, **Mayr) en haar Beteekenis voor de Cacao-Cultuur op Java.** [The Black Cacao Ant, *Dolichoderus bituberculatus*, Mayr, and its Importance in Cacao Cultivation in Java.]—*Meded. v. h. Proefstation Midden-Java, Salatiga*, no. 25, 1917, 142 pp., 4 figs., 4 diagrams, 2 plates.

Helopeltis having greatly increased in Java during the last three years in spite of direct measures, the consideration of other methods became advisable, and an investigation was undertaken to ascertain the actual value of *Dolichoderus bituberculatus*, Mayr (black cacao ant), the influence of which on *Helopeltis* was first noticed by two planters in 1908, since when some others have introduced it into their estates.

The first three sections of this paper comprise a systematic review with notes on both the young and mature forms of *D. bituberculatus*, the next section dealing with its general biology. It may be described as a tree ant, as it usually nests in trees and large shrubs, sometimes in holes in buildings, but never in the ground. It appears to have originally inhabited woodlands or the edges of forests, though not dense, primeval ones. As the woods were gradually destroyed, *D. bituberculatus* spread to cultivated lands, while still retaining a preference for shady places; it never settles in inadequately shaded situations. The very primitive nest is found in any suitable cavity or sheltered position. If the site is incompletely closed in, the openings are protected with a material resembling cardboard. Such nests are found on the under-side of coconut leaves or among the flower-clusters of *Loranthus*, *Coffea robusta*, etc. This form, which Forel called a complementary nest, is the one usually found in Java, where the huge

nest, which he recorded near Singapore and called the chief nest, has not as yet been observed. As trees with suitable opportunities for nesting are preferred by *D. bituberculatus*, the planters affix artificial nests of leaves, etc., to the cacao trees requiring protection against *Helopeltis*. Complete shelter without too great exposure to heat or sunshine are the chief desiderata, while the food-supply must be near at hand. It is for this last reason that the ant colonies are numerous only where sugary plant-exudations and insect-secretions occur. As *D. bituberculatus* is a tropical species, its habitat is restricted to definite temperature limits, which in Java extend to an altitude of about 4,300 feet, or 2,000 feet above the limit of cacao cultivation. During the greater part of the year the colonies contain—besides eggs, larvae and pupae—only two mature forms, the workers and apterous queens. Their number, and the size of the colony, vary very widely, probably according to the accommodation available. Small colonies of not more than thirty individuals may be found between two leaves in contact, while several dozen are present in artificial nests built of leaves. The queens are sometimes very numerous: in an artificial nest of cacao leaves examined in December 1916 there were 610 queens, or 1 to every 90 [*sic*] of the 52,000 workers. Oviposition is exclusively confined to these queens, and as each of them lays at least 1,300–1,700 eggs, the need for an abundant food-supply is obvious. During the first months of the east monsoon (late June to early September) the winged sexual individuals appear in large numbers. In a colony examined in July 1916 there were 680 alate females, 950 alate males, 620 queens, 19,000 workers and a quantity of brood.

The spread of *D. bituberculatus* in cacao plantations is usually due to the migration of individuals owing to the increase in numbers which normally occurs in a colony where one or more queens are present. The death of the queens involves the gradual extinction of the colony, for, although new queens may be reared from brood left by the dead ones, they deposit few or no eggs. If the nesting place becomes too sunny or food becomes scarce, the colony migrates. The ants rarely travel on the ground; their migrations are easily seen and when they are in the direction of cacao plantations their passage can be facilitated by bridging obstacles with bamboos.

The food of *D. bituberculatus* is, in general, similar to that of most ants. This species is not predaceous, however, and it is not a scavenger, one reason being that it lives on bushes and trees where the dead bodies of insects are not abundant. Its chief food is the honey-dew excreted by Coccids and Aphids. The extra-floral nectaries of many tropical plants, especially of the Leguminosae, are sought for, as also are the resinous exudations on bamboo, etc. Workers have been seen carrying the pollen of *Luffa acutangula* and the half-ripe seeds of *Fleurya interrupta* to their nest.

D. bituberculatus does not remove any of the three Aphids, *Toxoptera aurantii*, Boyer, *Aphis malvae*, Koch, and *A. medicaginis*, Koch, which occur on cultivated plants in Java, nor *Coccus* (*Lecanium*) *viridis*, the scale injuring coffee, nor *Pseudococcus crotonis*, Green, common on cacao and other plants. The construction of galleries over scale-colonies is usually carried out when the latter are already more or less protected by reason of their situation and chiefly in the case of the species less given to migration. Such galleries have been seen over

Coccus viridis, *Pseudococcus crotonis*, *Eucalymnatus* (*Lecanium*) *perforatus* and *Icerya* sp. Aphids, which are more mobile than scales, are scarcely ever protected in this manner, the only instances observed being with *Oregma loranthi*, *Thoracaphis fici* and other sluggish species. As the galleries apparently provide shelter against sun and rain they serve the ants also, but the latter do not use them for breeding purposes so long as the scales are present. Although *D. bituberculatus* cannot be said intentionally to protect scales against their enemies, the practical result of its attendance is to ward them off. It certainly does not attack the Ichneumonid or Coccinellid enemies of *C. viridis*, nor those that attack *P. crotonis*, though its presence disturbs them. A note on the favourable influence of *D. bituberculatus* on the scales visited by it [see this *Review*, Ser. A, v, p. 274] closes this section on the relations between this ant and Aphids and Coccids. Other insects, such as various Membracids (*Ebhul varius*, Walk., *Gargara* sp., etc.), Psyllids and Aleurodids (*Aleurodes eugeniae*, Mask., etc.) are visited by *D. bituberculatus* in its quest for honey-dew. The larvae of *Gerydus boisduvali* and other Lycaenids feeding on Aphids and Coccids are visited for the same purpose.

The natural enemies of *D. bituberculatus* include the Tachinid fly, *Bengalia latro*, de Meij., and the bug, *Ptilocerus ochraceus*. The former is unimportant, and the latter is a general enemy of the ant. *D. bituberculatus* does not interfere with other colonies of its own species so long as food is plentiful, but a shortage leads to bitter combats, so that sufficient space between the colonies must be allowed for when introducing the ant into a plantation. Towards other species *D. bituberculatus* is even more hostile under the above circumstances and its numbers often enable it to triumph over *Plagiolepis longipes* (gramang ant) and species of *Cremastogaster*, *Pheidologeton* and *Monomorium*.

A detailed account is given of the experiments made to determine the exact relation of *D. bituberculatus* towards *Helopeltis*, and these have established its value in protecting cacao trees against the latter, which also appears to be prevented from ovipositing on them. This is due to disturbance by the ant and by the white cacao scale, *Pseudococcus crotonis*, tended by it. Cacao is also protected to a considerable extent, though not completely, against its other great pest in Java, the cacao moth, *Acrocercops cramerella*. Regarding the influence of *D. bituberculatus* on *P. crotonis* the following conclusions are reached: The mortality of the scale is greatly reduced; its development is somewhat accelerated; its progeny is considerably increased; and parasitation is hindered. The presence of *D. bituberculatus* is therefore distinctly beneficial, which is not the case with all other ants [see this *Review*, Ser. A, v, p. 274]. Although complete symbiosis cannot be said to exist between *P. crotonis* and *D. bituberculatus*, the relation between them is very marked. Especially in cacao plantations, it may be said that while the absence of *D. bituberculatus* entails that of *P. crotonis*, the converse also obtains.

All the above statements and observations relate to cacao plantations. *D. bituberculatus* was formerly rather abundant in the plantations of Liberian coffee in Central Java, but at present it is not particularly common, probably because the coffee now grown (*Coffea robusta*) is not shaded to the same extent. *D. bituberculatus* is mostly

found where coffee borders on cacao, or where these plants are intermingled. In coffee gardens the ant also apparently feeds on resinous exudations of a vegetable nature, besides searching for the secretions of *Coccus viridis*, which it aids, though to a less degree than does *Plagiolepis longipes* [see this *Review*, Ser. A, v, p. 274], so that it is harmful, though not the cause of much injury. It also greatly hinders the labourers harvesting the coffee berries. *D. bituberculatus* is partly responsible for infestation by the so-called "Robusta" caterpillars, which are attracted by the excreta of *Coccus viridis* and *Pseudococcus citri*, tended by this and other ants, and as it does not appear to play any useful rôle in coffee plantations, its presence there is distinctly harmful.

For establishing *D. bituberculatus* in cacao plantations the presence of adequate shade is necessary. Other ants must be combated, especially *Plagiolepis longipes* [see this *Review*, Ser. A, iii, p. 664; v, p. 275]. The introduction of *Pseudococcus crotonis* is also very necessary, for it is only where this scale occurs that *D. bituberculatus* can maintain itself for a long period. The scale is best introduced on the empty shells of infested cacao pods after they have been carefully opened at harvesting time. As a supplementary measure such trees as *Tephrosia candida*, randoe (*Ceiba pentandra*) and *Deguelia microphylla* may be planted among the cacao. To introduce *D. bituberculatus* leaf-nests are hung up in places where the ant abounds, and when they are well infested they are removed to the cacao trees. The description given of the nests of *D. bituberculatus* shows that protected situations at some height above ground are preferred. Such places are not often met with in a well-kept plantation, but the difficulty has been solved by arranging artificial nests, of which many forms are described. One type is made of the woody bracts of bamboo, bent and tied down so as to form a case which is filled with cacao or banana leaves; another consists of a section of bamboo stem, also filled with leaves, and a third is a conical nest of leaves secured together. The nests must be hung on young branches near the pods, and cacao plants not yet in bearing should also be protected in this way.

The cost of this efficacious means of protecting cacao against *Helopeltis* is greater than that of the direct methods of collection or burning with torches. The following costs were worked out on an area of about 52 acres, each of 500 plants, and do not include a charge of about 6*s.* per acre, which might be required to free the ground from *Plagiolepis longipes*. If six nests per tree are necessary to begin with, the manufacture of 3,000 nests per acre will cost about 6*s.*, filling them with leaves and hanging them up will cost about 3*s.*, and the introduction of *Pseudococcus crotonis*, about 1*s.*, or about 10*s.* in all for the first year. In the following years the annual cost may amount to about 4*s.* per acre, assuming that four nests per plant have to be renewed. The cost of direct work against *Helopeltis*, such as collection and burning with torches, varies considerably, the average figures ranging from 1*s.* 8*d.* to 4*s.* 2*d.* per acre. This is considerably lower than that of introducing and maintaining *D. bituberculatus*, but the latter method requires less attention and labour and is therefore the best for combating *Helopeltis* on cacao.

A supplement to this paper deals fully with *Pseudococcus crotonis*, particulars being given of its systematic position, developmental forms,

general biology, relation to climate, spread, and food-plants. Its enemies include a midge (*Diplosis* sp.), a Chalcid, a Coccinellid (*Scymnus* sp.) and the Lycaenid, *Spalgis epius*. In some cases *P. crotonis* undoubtedly causes slight injury to cacao, but its presence should be encouraged in cacao plantations in view of the protection it affords against *Helopeltis* and to a lesser degree against *Acrocercops cramerella*. This supplement concludes with notes on the physiology of the sucking of this scale.

SHIRAKI (T.). **Paddy Borer,** *Schoenobius incertellus*, **Wlk.**—*Agric. Expt. Sta. Government of Formosa, Taihoku*, 1917, 256 pp., 1 map, 22 pl.

This elaborate and detailed monograph deals exhaustively with *Schoenobius incertellus*, Wlk., the Pyralid moth boring in rice, which, owing to the great difference between the sexes, has been redescribed on more than one occasion, *S. bipunctifer*, Hmps., being the female, and other synonyms being *S. punctellus*, Z., and *S. minutellus*, Z.

The insect has a wide range throughout India, Ceylon, China, Japan and the islands of the Malay Archipelago, occurring widely in lowland districts on cultivated rice, while it is absent from the highland areas and apparently does not attack wild plants, except in Burma, where it feeds on wheat and grasses. In Ceylon, which appears to be its original home, it is not known to attack rice, and its food-plant there is still unknown. In Formosa and Japan it is an important pest, being more widely distributed and destructive than in India and the Philippines.

The moth, which is nocturnal, oviposits between 6 and 10 p.m. during the spring, summer and autumn months, the long, elliptical egg-clusters being laid near the tip of the leaf. The egg hatches in 6 or 7 days; in Japan this period is lengthened from 8 to 10 or 15 days. Immense numbers are destroyed by the mechanical action of rain storms, which remove the clusters from the plants, and although these may hatch, the larvae die through being unable to find their host-plant. The eggs are parasitised by three small Hymenoptera, viz.:—*Trichogramma japonicum*, Ashm., which destroys about 23 per cent., but is unfortunately preyed upon by dragon-flies, spiders, and the Staphylinid beetle, *Paederus idae*; *Phanurus* (*Ceraphron*) *beneficiens*, Zehnt., which also attacks the eggs of *Chilo simplex* and *Diatraea venosata*, Walk. (sugar-cane Pyralid) during the winter; and by *Tetrastichus* sp. One of the most important insect checks is the predaceous ant, *Pheidole noda*, Smith.

The larvae, of which the majority die immediately after hatching, moult four times during a larval period of about three weeks. The newly-hatched larvae bore into the young stems, the lower part of which they reach in from three to five days. After a week they leave the stems, and having made for themselves cylindrical cases from the rolled up leaf tips, they drift in them on the irrigation water in search of a fresh host-plant. This found, the larva enters the basal part of the stem, where it pupates after spinning a protective covering over the spot.

These larvae do the greatest amount of injury during the period before the shooting of the ears. They are parasitised by the

Braconids, *Shirakia dorsalis*, Matsumura, *Amyosoma chilonis*, Vier., and *Stenobracon maculata*, Mats.; by the Ichneumonids, *Apanteles simplicis*, Vier., *Eripternimorpha schoenobii*, Vier., *Eripternus ? akoensis*, sp. n., and *Trathala ? flavopedes*, sp. n.; and by the Phorid, *Aphiochaeta parasitica*, sp. n. Various predaceous insects attack them, including the Chloropid fly, *Anatrichus erinaceus*, Lw., the Staphylinid beetles, *Paederus idae*, Lewis, and *P. mixtus*, Sharp, and the ant, *Tetramorium guincense*, F. They also suffer from a bacterial disease of unknown origin.

The pupal stage lasts for ten days to a month, the moths emerging from February to October (May to September in Japan). The adult is capable of a five-mile flight, and there are six generations a year in tropical countries. Its natural enemies are *Ommatius fulvidus*, Wied., and other Asilids, the wasps, *Icaria* sp. and *Polistes hebraeus*, F., and the dragon-flies, *Pantala flavescens*, F., *Rhyothemis splendens*, Ramb., *Asisoma panorpoides*, Ramb., *Trithemis trivialis*, Ramb., *Lepthemis sabina*, Drury, *Orthetrum albistyla*, Selys, and *Agrion* spp., besides bats, spiders and frogs, and a bird, *Buchanga atra*.

As regards methods of control, the treatment of rice stubble by burning in a dry field, by ploughing in, in a moist field, or by submerging in a field that can be flooded, is undoubtedly the best, especially when put into practice over areas of at least five miles, and under strict supervision. If this cannot be done, the collection of the egg-masses before the shooting of the paddy is a useful measure.

A bibliography of 39 works is appended.

Grease-banding of Fruit Trees.—*Jl. Bd. Agric., London*, xxiv, no. 7, October 1917, pp. 750–752.

All standard apple, pear, plum and cherry trees, or any stakes used to support them, as well as any forest trees in the neighbourhood of an orchard, should be banded with some adhesive preparation to catch the females of the winter moth [*Cheimatobia brumata*], which would otherwise crawl up the trunks and lay their eggs on the stems and branches. The bands should be fixed three feet from the ground; the preparation should not contain a pungent oil or cart grease; and only the upper two-thirds of the band should be covered. The work should be done during September or before the middle of October, at latest.

An Experiment in Storing Seed-corn in Grenada.—*Agric. News, Barbados*, xvi, no. 401, 8th September 1917, pp. 276–277.

This paper is an account of experimental work conducted in Grenada by the Superintendent of Agriculture, Mr. J. C. Moore. In storing maize for seed it is necessary to remove as much moisture as possible, without destroying its vitality; consequently a high temperature cannot be employed, as in the case of storing maize for food. The cobs tied together in pairs were first hung across racks in a well-ventilated wooden room with a shingled roof, the windows and ventilators being screened with $\frac{1}{2}$ inch wire netting, but kept fully open except at night and during actual rainfall. A few weevils were noticed after hanging, but the only fumigation effected at this stage

was by means of a smouldering wood fire for about six hours at a time on three occasions, at intervals of two weeks.

The maize was shelled at the beginning of January, placed in the sun for two days, sifted to remove dust and chaff, fumigated with hydrogen cyanide for 16 hours and stored in a bin. This storage bin was 7½ ft. high and 4ft. square, made of closely fitted boards, one half of the top having a movable cover. The outside was tarred and the inside lined with roofing paper with overlapping edges, and running from the bottom of one side halfway across the floor was a suitably perforated flue that rose vertically through the centre of the bin to within 18 in. of the top. The lower part of the flue held a gas generator fitted with an air-tight door, so that the cyanide fumes could thoroughly penetrate the stored grain.

As this was put into the bin, muslin bags, each containing 3 oz. crude flake naphthaline, were distributed at regular intervals throughout the mass, though this did not seem to be efficacious in warding off insect attacks. Three cyanide fumigations at intervals of 10 and 16 days were applied during February and March, and further fumigations with carbon bisulphide in the middle of March and May. On opening the bin at the end of May a large number of weevils were found at the bottom, but the seed was clean and bright, entirely free from mildew, and practically free from weevils and moths, and had an indicated viability of 87 per cent. The experiment proved that hydrocyanic acid gas can safely be used in fumigating thoroughly dry seed maize, without much affecting its vitality.

Garman (P.). *Tarsonemus pallidus*, **Banks, a Pest of Geraniums.**—*Maryland Agric. Expt. Sta., College Park,* Bull. no. 208, June 1917, pp. 327–342, 13 figs. [Received 28th October 1917.]

The more common insect enemies of the geranium are general pests that attack the plant only when compelled to do so from lack of other more suitable food. These include the mealy bugs, *Pseudococcus citri* and *P. adonidum* (*longispinus*), the whiteflies, *Aleurodes citri* and *A. vaporariorum*, and the mites, *Tetranychus telarius* (red spider) and *Tarsonemus pallidus*. The latter mite has previously been described as the cyclamen mite [see this *Review*, Ser. A, v, p. 507], but since it attacks other plants with equally injurious effects, the author suggests the name pallid mite as being more appropriate. *T. approximatus* is regarded as a synonym of this species, which is closely allied to *T. floricolus*. The various stages and the life-history are described. Parthenogenesis was proved to occur in the females, the life-cycle of which occupies about 33 days; the males, which are much less numerous, have a shorter existence.

A high degree of humidity (80–90%) and a temperature between 60° and 80° F. are beneficial to the development of this mite, which usually migrates by crawling from one plant to another when the leaves are in contact. Most varieties of geranium are attacked by *T. pallidus*, which causes a scorched appearance on the under-side of the leaves; these ultimately curl up and drop prematurely. Heavily infested plants may lose all their leaves through the invasion of a fungus before they drop. Plants should be well spaced out to prevent migration of the mites.

A table records the effect of various insecticides on *T. pallidus*. Bordeaux mixture may be safely used on geranium foliage to kill the mites. Sulphur and other solutions were tried and discarded owing to injury to the foliage. Chromic and picric acids produced discoloration of the leaves, but a thorough watering of the plants on the day following this treatment might reduce the injury to a negligible amount. A stream of pure water will dislodge many of the mites, and this is a feasible method with geraniums, since the leaves do not curl so badly as to hide the mites as in the case of snapdragon.

Allard (H. A.). **Further Studies of the Mosaic Disease of Tobacco.**—*Jl. Agric. Research, Washington, D.C.*, x, no. 12, 17th September 1917, pp. 615–631, 1 plate.

It was observed during the winter and spring of 1912 that Aphids were in some manner associated with outbreaks of the mosaic disease of tobacco [see this *Review*, Ser. A, i, p. 19]. Experiments have since shown that some Aphids may become active carriers of the infective principle of the disease, though all species do not appear to transmit it with the same readiness. The green peach aphis, *Myzus persicae*, Sulz., is an active carrier in the greenhouse, where it is found on a variety of plants. Under field conditions *Macrosiphum tabaci*, Perg., appears to be an efficient carrier of the disease, and there is strong reason for suspecting that the widespread epidemic of mosaic disease that affected tobacco, tomatoes, and datura during 1913 was due to the presence of this Aphid, colonies of which were found on the under-sides of the ground leaves of almost every tobacco plant in the field. *Tetranychus telarius*, L. (red spider) and *Aleurodes vaporariorum*, Westw. (whitefly) have given negative results with regard to transmission of this disease. It is found that if Aphids are excluded from the greenhouse by fumigation, the occurrence and spread of the mosaic disease of tobacco becomes a negligible factor, while it cannot be controlled so long as *Myzus persicae* is allowed to multiply unchecked.

McHargue (J. S.). **A Study of the Proteins of Certain Insects with Reference to their Value as Food for Poultry.**—*Jl. Agric. Research, Washington, D.C.*, x, no. 12, 17th September 1917, pp. 633–637.

This paper shows by comparative analyses that *Melanoplus* spp. (grasshoppers) and *Lachnosterna* sp. (June bugs) contain proteins similar both in character and quantity to those contained in the higher animals that furnish a large part of human food. The results of protein determinations on these two insects are given in a table and are contrasted with the protein content of roast beef and turkey under the same method of analysis, the results showing considerable similarity. Experiments show that grasshoppers deprived of their moisture contain a higher protein content than commercial meat meal and in all probability could be made an efficient substitute for it. It is pointed out that the instinct in wild and domesticated birds which guides them in their natural selection of the most efficient food is confirmed by the high lysin content found in the insects thus far examined.

Luginbill (P.) & Ainslie (G. G.). **The Lesser Corn Stalk-Borer.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 539, 8th September 1917, 27 pp., 3 plates, 6 figs.

Elasmopalpus lignosellus, Z. (lesser corn stalk-borer) has hitherto appeared abundantly only in sporadic outbreaks, but has lately become an important pest in the southern United States, where crops grown in poor and sandy soils are readily affected.

This paper is a compilation of the results of observations and experiments made during the years 1913–1915. Injuries due to this moth were first recorded in 1881, but it was twenty years later before it became the subject of entomological study. The species occurs practically throughout South America and almost over the entire southern half of the United States. Gramineae are the favourite food-plants and would probably be exclusively attacked, if always obtainable. Beans, maize, cow-peas, Japanese cane, Johnson grass, peanuts, sorghum, sugar-cane, turnips and wheat are among the crops attacked. Descriptions of all stages of the insect are given. Eggs have not been found in the field, but judging from the results obtained from rearing, they are probably deposited on the stems of plants, in the axils of the leaves or on the ground at the bases of the stalks, which the larvae ascend in order to feed. The eggs are generally deposited singly, 190 being about the average number for each female. Oviposition has not been known to occur at a temperature of much less than 80° F. The larvae hatch in three to six days according to temperature and pass through four to seven instars according to the season, the average length of the larval period being 17 days, or considerably longer at low temperatures. The larvae bore into the stems of young plants and make tunnels near the surface of the ground, where they feed, the injury closely resembling that of the southern corn rootworm, *Diabrotica duodecimpunctata*, Oliv. In older plants the stems are frequently girdled at or slightly below the ground surface. The larvae are seldom found in the tunnels of the plants, but more often in specially constructed tubes which lead away from the entrance to the tunnel, lying even with or slightly beneath the surface of the ground, or sometimes curved round the stems. These tubes are composed of particles of sand and dried excrement spun together with silk by the larvae, which apparently use them as a means of retreat if disturbed while feeding. The pupal stage varies according to temperature from 7 to 21 days, and the adults live from 5 to 18 days. There are probably four generations in a year, the summer broods averaging 38 days for the total life-cycle and the autumn broods 64 days. The winter is apparently passed in the larval and pupal stages.

Natural enemies exercise very little control on the borer, owing to the protection afforded to the larvae at all times. An Ichneumonid, *Neopristomerus* sp., was reared from this species in the laboratory and the Braconid, *Orgilus laeviventris*, Cress., has been obtained in Florida.

Cultivation is the best method of combating the borer. Infested fields should be ploughed in late autumn or early winter after all remains of the old crop have been removed and the borders of the field should be harrowed to stir up the ground and break up the winter quarters of the pupae. Any sandy areas in the field should be treated

with fertilisers to enrich the soil and stimulate plant growth. Maize, sorghum and allied crops sown in fields liable to infestation should be planted as early in the season as possible, to enable the plants to get a good start before the insect becomes active.

MELANDER (A. L.). **The Strawberry Root Weevil.**—Separate, dated 5th January 1917, from *Rept. Proc. Washington State Hortic. Assoc., Pullman*, 1917, 4 pp. [Received 23rd October 1917.]

The strawberry root weevil, *Otiorrhynchus ovatus*, an important pest of strawberries in British Columbia [see this *Review*, Ser. A, v, p. 469] occurs in the northern States all across the continent, having been introduced from Europe about fifty years ago. The insect hibernates in the larval stage, from 2–4 inches in the soil, pupating in the spring, the adults emerging when the strawberry crop is ripe and ovipositing by the time it is picked. Mowing and harrowing the plants in midsummer simply serve to scatter the weevils broadcast, and they cannot be starved out of a field by ploughing out the plants, as they can subsist on many host-plants. Experiments undertaken in May, when the insects were all beneath the soil, reduced the problem of their control to one of subterranean treatments. Crushing the insects in the ground by means of sledge-hammers till the ground was pulverised was found to be ineffective, as only half the weevils were thus killed. Attempts to drown the weevils were a failure, as they revived unharmed from a submergence of two days. Burning out the insects was equally impossible, the insects just beneath the baked surface being quite unharmed. Soaking the soil with contact insecticides, such as strong soapsuds, oil emulsions and copperas solutions, killed the plants, but failed to affect the weevils or their larvae. Killing by poisonous fumes and gasses was attempted with various substances including carbolineum, crude pretroleum, gasoline, kerosene, turpentine, chloroform, carbon bisulphide, chlorine, sulphur dioxide, acetylene and hydrocyanic acid gas. Of these, only the last-named and carbon bisulphide gave any results, as the effects did not extend for more than a few inches from the point where the materials were used. Owing to the danger attending its use and the fact that it killed the plants, the cyanide was discarded, but good results were obtained with carbon bisulphide in the following way. The infested rows were covered with a 30-foot strip of canvas or cloth sheeting made gas-tight by painting with linseed oil, under which, at intervals of 5 ft., saucers each containing $\frac{2}{3}$ oz. of carbon bisulphide were placed. When necessary, the canvas was raised above the saucers by wooden props to allow of free evaporation and made air-tight at the edges by earth shovelled on to it. This treatment killed the adults, larvae and pupae, as well as wireworms, Tipulids and other insects, and is best applied during the few days after the crop is gathered, before migration and egg-laying begin.

MASKEW (F.). **Quarantine Division. Report for the Month of June 1917.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, **vi**, no. 9, September 1917, pp. 376–377.

The following pests were intercepted :—From China : Lepidopterous larvae in dried herbs, and weevil larvae in sweet potatoes. From

Florida: larvae of *Pieris* (*Pontia*) *rapae* on celery and *Lepidosaphes beckii* on grape-fruit. From Hawaii: *Diaspis bromeliae* and *Pseudococcus bromeliae* on pine-apples; *Coccus longulus* on betel leaves. From Japan: *Pulvinaria* sp. on an unknown plant; larvae of a weevil in sweet potatoes; *Pseudaonidia* sp., *Ceroplastes* sp., and *Parlatoria* sp. on an unknown pot-plant; *Thyridopteryx ephemeraeformis* on *Thuja obtusa*; and a weevil in beans. From Java: weevils in dried ginger. From Manila: *Pseudaonidia* sp. on beagle nuts. From Mexico: *Calandra oryzae* and Lepidopterous larvae in seeds; *Asterolecanium* sp. on oleander; *Lepidosaphes lasianthi* on croton. From New Jersey: *Dialeurodes citri* and *Pseudococcus* sp. on gardenia; green aphis on chrysanthemum plants. From New York: *Diaspis boisduvali* and *Isosoma orchidearum* on orchids; *Aspidiotus hederae* on *Ceropegia saundersi*; *Diaspis* sp. on *Billbergia distachii* and on *B. leopoldi*; *Gymnaspis aechmeae* on *Billbergia saundersi*; *Pseudococcus* sp. and *Parlatoria* sp. on lemon plant; *Saissetia oleae* on *Rhipiates rhombera*; an unidentified Coccid on *Virsal* sp.; *Pseudococcus* and *Aleurodes* sp. on ornamental plants. From Tahiti: Lepidopterous larvae in seeds of *Barringtonia* sp.; *Lepidosaphes beckii* on limes. From Arizona: *Heliothis* (*Chloridea*) *obsoleta* in green maize. From Central America: *Aspidiotus cyanophylli* on bananas. From Rhode Island: green aphis on dahlia roots. From Texas: *Aleurodes* sp. on Cape jasmine buds. From Ohio: *Pseudococcus* and *Aleurodes* sp. on coleus.

Ehrhorn (E. M.). **Division of Plant Inspection.**—*Hawaiian Forester & Agriculturist, Honolulu*, xiv, no. 8, August 1917, pp. 212–216.

Pests intercepted during the month of June included scale-insects on plants from Manila and palm aphis on orchids from England; 1,200 bags of wheat were found badly infested with the grain weevil [*Calandra granaria*] and were fumigated for 48 hours with carbon bisulphide. The radish maggot [*Chortophila brassicae*] was found infesting 4 cases of turnips which were destroyed.

During July 100 bags of Japanese rice were fumigated against the rice moth, *Paralipsa modesta*.

Fullaway (D. T.). **Division of Entomology.**—*Hawaiian Forester & Agriculturist. Honolulu*, xiv, no. 8, August 1917, pp. 216–218.

During the months of June and July from 54,400 pupae of the melon fly [*Dacus cucurbitae*] 2,351 individuals of *Opius fletcheri* were bred and distributed. Other beneficial parasites liberated included *Diachasma tryoni*, 270; *Tetrastichus*, 850; *Galesus*, 150; *Paranagrus* (corn leaf-hopper parasite), 12,500.

Nowell (W.). **Internal Disease of Cotton Bolls in the West Indies.**—*West Indian Bull., Barbados*, xvi no. 3, 1917, pp. 203–235.

Cotton staining has been shown to be due to the infection of the contents of the boll with certain fungi, four species of which have been found, or with bacteria, these organisms gaining access by means of the punctures made by bugs, chiefly *Dysdercus* spp. (cotton stainers) and *Nezara viridis* (green bug). In India the damage is caused by *D. cingulatus*, F., and in Egypt by *Oxycarenus hyalipennis*, Costa.

The infestation of cotton fields with stainers originates from waste land on which their wild food-plants exist, the chief of these being *Eriodendron* (silk-cotton tree), *Thespesia*, and various Malvaceous herbs and shrubs. They also feed, without breeding, on many species of plants.

SANDS (W. N.). **Observations on the Cotton Stainer in St. Vincent.**—*West Indian Bull., Barbados*, xvi, no. 3, 1917, pp. 235–252.

The most serious pest of cultivated cotton in St. Vincent is *Dysdercus delauneyi*, Leth., which occurs abundantly throughout the coastal district. Up to the present it has not been found to breed on any species of plant other than those belonging to the order MALVACEAE, or the closely allied STERCULIACEAE. Its chief host-plants are *Eriodendron anfractuosum* (silk cotton), and *Thespesia populnea* (mahoe, or John Bull tree), and to a lesser extent, *Hibiscus esculentus* (okra), *Ochroma lagopus* (cork-wood tree) and *Malachra capitata* (wild okra). It has been found feeding, but not breeding, on the flowers of *Mangifera indica* (mango), *Eupatorium odoratum, Cordia cylindrostachys* (black sage), *Moringa pterygosperma* (horse radish tree), on the fruit of *Momordica charantia* and on the secretions of scale-insects.

Since, by law, all wild and cultivated cotton plants must be pulled up and burnt by 30th April, the insect could not be carried over from one season to another were it not for these wild trees on which it can subsist in the interval. The destruction of these was therefore carried out at Government expense from August 1916 to April 1917, during which time 1,542 plants of *E. anfractuosum* and 11,570 of *T. populnea* (besides several thousands of seedlings) were destroyed, at a total cost of £300.

Other suggested measures are :—a close season for cotton from February to May ; the trapping of the pest by means of cotton seed, seed-cotton, or cotton-seed meal just before the cotton begins to flower ; and the collection of cotton stainers in the field.

The natural enemies of the insect are few, the chief being the birds, *Tyrannus rostratus* and *Crotophaga ani*, as well as domestic fowls, which destroy the bug to a limited extent, a small externally-parasitic mite, and certain ants which prey on the eggs.

HARLAND (S. C.). **A Note on Resistance to Black Scale in Cotton.**—*West Indian Bull., Barbados*, xvi, no. 3, 1917, pp. 255–256.

At the beginning of the sea island cotton industry in the West Indies, *Saissetia nigra*, Nietn. (black scale) was found to be a very serious pest. It has now been shown that of the Seredo cottons introduced into St. Vincent in 1914, all of which are immune to *Eriophyes gossypii*, Banks (leaf-blister mite), two types are also quite immune to black scale, the immunity being inherited, and in breeding experiments behaving as a partial dominant.

TREHERNE (R. C.). **The Apple Maggot in British Columbia.**—*Canadian Entomologist, London, Ont.*, xlix, no. 10, October 1917, pp. 329–330.

The two adult flies captured on apple in British Columbia in August, 1916 [see this *Review*, Ser, A, v. p. 121] have finally been determined

as *Rhagoletis pomonella.* They are the first examples of this species taken in British Columbia ; no sign of larval injury has as yet been observed. Five specimens of this species were collected in southern California in 1894, when they were described as *R. zephyria* ; since that time, the fly has not been recorded from California, but has been observed in Colorado and on the eastern border of Washington State.

CHAMBERLIN (W. J.). **An Annotated List of the Scolytid Beetles of Oregon.**—*Canadian Entomologist, London, Ont.*, xlix, no. 10, October 1917, pp. 353–356.

This paper completes the list of the Scolytids of Oregon [see this *Review*, Ser. A, v, p. 527]. The more important of the species dealt with include *Phloeosinus dentatus*, Say, of which a single specimen was collected from *Chamaecyparis nootkatensis*, and *P. punctatus*, Lec., which causes considerable damage to *Juniperus occidentalis*. These beetles excavate a gallery about 1-2 in. long parallel with the grain of the wood, the females depositing eggs in recesses on each side, which are sealed up by a wall of frass. The young larvae bore their way out roughly at right angles to the egg-gallery. Eggs, larvae and pupae were all found in May. Apparently all trees of the juniper and cedar group are attacked ; in the mines in juniper, the cocoons of an unidentified Hymenopterous parasite were found. *Pseudohylesinus nebulosus*, Lec., emerges in March and prefers to attack Douglas fir, either living, dying or felled, especially in the sapling and pole stages. When such timber is not available, the limbs of larger trees are selected. A gallery is bored through to the cambium ; the female then works parallel with the grain and the male in the opposite direction. Eggs and larvae occur similarly to those of *Phloeosinus punctatus*. *Pseudohylesinus nobilis*, Swaine, and *P. laticollis*, Swaine, occur in *Abies nobilis*, while a very large specimen of *Pseudohylesinus*. sp. n., has been taken boring in *Cedrus leboni*. *P. griseus*, Swaine, and *P. sericeus*, Mannh., taken on Douglas fir, closely resemble *P. nebulosus* in their life-history and habits. *Pityophthorus pubipennis*, Lec., occurs abundantly in ash (*Fraxinus oregona*) and oak (*Quercus gerryana*). *Pityogenes carinulatus*, Lec., is found girdling and killing twigs and small branches of yellow pine. A rough, circular chamber is eaten out and from this radiate five to eight short egg-galleries. Adults, young larvae and eggs were all collected in May. *Pityophthorus* sp. n., similar to *P. nitidulus*, Mannh., which is found in dying *Pinus*, has been frequently collected from *Abies grandis* and *A. nobilis*. *Trypodendron* sp. n., near *rufitarsis*, Kirby, which attacks *Pinus contorta*, has been collected from Douglas fir. *Xyleborus dispar*, F., is recorded in orchard trees in various localities.

AINSLIE (C. N.). **Notes on the Construction of the Cocoon of *Praon*. (Hym., Braconidae).**—*Entom. News, Philadelphia*, xxviii, no. 8, October 1917, pp. 364–367.

It is a well-known fact that Braconid larvae, parasitic on Aphids, attach the dead body of the host to some firm base, such as the leaf on which it had been feeding, in order to secure shelter for themselves during the period of pupation. An exception to this is found in the

case of the genus *Praon*, which attacks the larger Aphids. The larva of this genus constructs a tent-like cocoon beneath the body of its host for a pupation chamber. The body of the host having been rent ventrally, the emerging larva spins a cocoon in the space formed by the long legs of the Aphid host between its body and the leaf. The adults emerges in about seven days from the time the larva begins to spin itself in.

CROSBY (C. R.) & LEONARD (M. D.). **An Egg Parasite of the Sumac Flea-beetle.**—*Entom. News, Philadelphia,* xxviii, no. 8, October 1917, p. 368, 2 figs.

Tetrastichus ovipransus, sp. n., a Hymenopterous parasite reared from the eggs of *Blepharida rhois,* Forst. (sumac flea-beetle) is described.

DE BUSSY (L. P.). *Lasioderma* **in Deli en zijn Bestrijding.** [*Lasioderma* in Deli and Methods of combating it.]—*Meded. Deli Proefstation, Medan,* **x**, no. 6, July 1917, pp. 129–160, 1 plate. [Received 27th October 1917.]

In order to cope with *Lasioderma serricorne* in Sumatra not only must imported tobacco be dealt with, but the planters must carry out the instructions repeatedly issued by the Deli Experiment Station.

At the present time large quantities of baled tobacco, which cannot be shipped, are stored in every plantation, and all cigars, cigarettes, etc., brought there must be very carefully examined, all instances of infestation being reported for "blacklisting," if necessary [see this *Review*, Ser. A, v, p. 41]. The fumigation of all imported tobacco with a vacuum apparatus and carbon bisulphide will entail many difficulties, including the complete removal of all traces of the bisulphide and the subsequent sealing of the packages, as these operations must be done by trained men, the cost of whom will have to be borne by the consumers. Furthermore, while cured tobacco is the favourite food of *L. serricorne*, a large number of other substances are also attacked and would require to be fumigated on importation. Experiments with a large number of likely food-stuffs showed that *L. serricorne* multiplies rapidly in the following: Chinese bread, caraway seed, *Vigna catjang,* coriander seed, *Glycine soja,* maize, rice (unshelled, shelled, or cooked with sugar), rice husks, *Diospyros horsfieldi* (both fruit and seed), wheat flour, and the dried fruits of tempajang. Before these food-stuffs are stored on plantations they ought to be inspected.

In Deli the complete life-cycle of *L. serricorne* appears to take from six to nine weeks; within a bale of fermenting tobacco the period may be shorter. Temperatures even over 122° F. do not hinder development. Most fermenting sheds are free from *Lasioderma* when the new tobacco is brought in. Female beetles attracted by the smell of the tobacco oviposit there, but when the new piles (known as A-piles) are broken up and re-made most of the eggs are destroyed; this also occurs in the case of the re-made piles (B) and in those (C) again formed from the latter. It is only in the still older D-piles that *L. serricorne* can develop undisturbed. The resultant beetles mate, but the bulk of their progeny perish when the tobacco is sorted. The few that remain multiply in the piles of sorted-out tobacco and the injury then begins. Great watchfulness is therefore needed when the early piles are being

handled, and the discovery of one single larva in a C-pile may prevent great subsequent loss. Sometimes *L. serricorne* is already present in fermenting sheds in baskets, piles, or bales of the previous year's tobacco, and the infestation then becomes general. The duration of the egg-stage was not ascertained. The pupal stage lasts only five days, but the beetle remains for another five days within the cocoon. Great variations in the number of progeny were observed.

Infested tobacco used formerly to be sold as such at a low price or burnt, but nowadays it is cleaned and sold in good condition. *L. serricorne* is usually discovered when the piles of sorted-out tobacco are broken out for baling. A mosquito-net chamber should at once be erected over the infested pile and workers within it should search for damaged leaves, larvae and beetles. A suitable reward should be offered for the catches and all infested leaves should be burnt, while the others are baled. All the bales must be fumigated with carbon bisulphide in any building suited to the purpose, or one may be built of planks, the size recommended being 32 feet long by 16 feet wide by 8 feet high. For ensuring the destruction of the pest 300 c.c. of carbon bisulphide per cubic metre should be used, or about 70 pints for a disinfecting room of the size given. Great precautions must be taken against fire in any form being brought near the room. The fermenting shed must also be thoroughly freed from infestation.

The necessity for all planters to adopt preventive and remedial measures is insisted on, as perfectly sound bales may be infested on board ship. Quite recently larvae were found outside a sound bale, in a tear near the seam of the covering. The mother-beetle had apparently tried to enter the bale at that point and had deposited eggs along the seam.

LEGISLATION.

Hewitt (C. G.). **Regulations under the Destructive Insect and Pest Act, with Instructions to Importers and Exporters of Trees, Plants and Other Nursery Stock.**—*Canada Dept. Agric., Ottawa,* Entom. Circ. no. 10, 16th August 1917, 12 pp. [Received 4th December 1917.]

This circular contains Regulations which have already been published [see this *Review*, Ser. A, v, p. 479] and gives some explanations and instructions for persons importing nursery stock into Canada. The Destructive Insect and Pest Act of 1910 is quoted verbatim.

ENTOMOLOGICAL NOTICES.

We regret to announce the death of Mr. C. W. Mason, Government Entomologist in Nyasaland.

Professor H. M. Lefroy is on his way to Australia in connection with an investigation into the pests of stored grain.

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